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A Critical Revision of the genus Eucalyptus

BY

J. H. MAIDEN, I.S.O., F.R.S., F.L.S.

(Government Botanist of New South Wales and Director of the Botanic Gardens, Sydney).

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"Ages are spent in collecting materials, ages more in separating and combining them. Even when a system has been formed, there is still something to add, to alter, or to reject. Every generation enjoys the use of a vast hoard bequeathed to it by antiquity, and transmits that hoard, augmented by fresh acquisitions, to future ages. In these pursuits, therefore, the first speculators lie under great disadvantages, and even when they fail, are entitled to praise."

MACAULAY'S "ESSAY ON MILTON."

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(Government Botanist of New South Wales and Director of the Botanic Gardens, Sydney).

Vol. V. Part 1.

Part XLI of the Complete Work.

(WITH FOUR PLATES.)

"Ages are spent in collecting materials, ages more in separating and combining them. Even when a system has been formed, there is still something to add, to alter, or to reject. Every generation enjoys the use of a vast hoard bequeathed to it by antiquity, and transmits that hoard, augmented by fresh acquisitions, to future ages. In these pursuits, therefore, the first speculators lie under great disadvantages, and even when they fail, are entitled to praise."

MACAULAY'S "ESSAY ON MILTON."

PRICE TWO SHILLINGS AND SIXPENCE.

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DESCRIPTION.

CCXXIII. E. latifolia F.v.M.

Journ. Linn. Soc. iii, 94 (1859).

Following is a translation of the original :—

A tree with somewhat terete branchlets, leaves sub-opposite or scattered, with rather long petioles, broad or orbicular-ovate, obtuse, glaucescent, opaque, imperforate, thinly penniveined, intramarginal vein very close to the edge, umbels terminal, paniculate, few flowered, peduncles and pedicels angular, these twice as long as the former (*E. melanophloia*, &c.). Fruits sub-campanulate, ecostate, 3–4 celled, flat at the vertex, valves touching at the rim.

Growing in riparian level ground, at the upper part of the Roper River, 8th July, 1856. Flowered in the summer.

A small or medium-sized tree, the bark, after the falling of the last ashy-coloured strips, is smooth and yellowish. Leaves 2–3, rarely 4 inches long, often 2 inches broad, with a petiole of almost an inch long, thickly and faintly penniveined as those of *E. bigalerita* (*E. alba* Reinw., see Part XXV, p. 96, of the present work). Umbels simply and compositely paniculate. Fruit about 3 lines long, the margin slightly bent back at the mouth. Valves included. I have not found the flowers.

In habit similar to *E. bigalerita*, but in its characters rather resembling *E. dichromophloia*.

In spite of his reference to the inflorescence, it was either not seen by Mueller, or he had lost it (see under *E. Foelscheana*, p. 8). At all events, it has been figured (fig. 2*b*, Plate 168) for the first time. The individual umbels have six to twelve flowers. The colour of the timber is red.

Then Bentham (B.Fl. iii, 255) described it in English as follows :—

A small or middle-sized tree, with a smooth ash-grey bark, tardily separating from the inner brownish bark, also smooth (*F. Mueller*). *Leaves* alternate, or here and there almost opposite, petiolate, ovate, obtuse, with transverse parallel veins, rather more prominent and not so close as in the allied narrow-leaved species. *Flowers* rather large, four to six in each umbel, in a large terminal corymbose panicle. *Peduncles* terete; pedicels terete, shorter than the calyx-tube. *Calyx-tube* broadly turbinate, four to five lines in diameter, rather thick. *Operculum* very short, slightly convex. *Anthers* ovate-oblong, with parallel distinct cells. *Fruits* globose-truncate or urceolate-globose, with a very short neck, smooth, and not ribbed, 3 to 4 lines in diameter, the rim thin; the capsule deeply sunk. *Seeds* winged.

RANGE.

The type came from the upper part of the Roper River, and Bentham adds "Islands of the Gulf of Carpentaria," whence it was collected by Robert Brown about 1802, but what I have seen collected by that botanist on the islands belongs to *E. Foelscheana*. So far I have only seen specimens of *E. latifolia* from the Northern Territory and the big islands north of it. The Roper River, of course, flows into the western side of the Gulf of Carpentaria.

Following are notes on Northern Territory specimens in the National Herbarium, Sydney :—

"Grows on heavy soil and is associated with *E. papuana* and *E. terminalis*. The wood is soft." Has the ordinary friable Bloodwood bark, Bathurst Island (G. F. Hill, No. 464). Mr. Hill kindly sent a photograph of this tree. Bathurst Island (G. F. Hill, No. 469). In flower, which is fragrant.

"White bark, flaking off in places in strips. Conical fruits" (perhaps a reference to the narrow mouths). McKinlay River flats (Dr. Jensen, No. 388). "Bloodwood," McKinlay River flats (Dr. Jensen, No. 390).

Pine and Horseshoe Creeks (E. J. Dunn and R. J. Winters).

"Bloodwood," fairly large tree, near Pine Creek (C. E. F. Allen, No. 107).

Note (*a*). "Bastard Bloodwood." "Similar in habit to the Bastard Bloodwoods and Cabbage Gums identified as *E. grandifolia* and *E. Foelscheana* (narrow leaf tall form). The leaf is always stout and untwisted, but in the roughish bark, with red gummy splashes, and the crooked habit of the tree, it resembles the other two." (Jensen, No. 385).

Note (*b*). "Crooked limbed small tree, growing however in other places up to 40 feet high. Roughish bark except on branches where it is white and smooth. Stem up to 12 inches in diameter. Capsules in small terminal racemes. Leaves ovate." Pine Creek (Dr. Jensen, No. 357).

"Cabbage Gum," near Wandi (Dr. Jensen, No. 383). "Bastard Bloodwood." Roughish bark over most of the stem, branches often smooth. Near Wandi (Dr. Jensen, No. 385).

"Timber pale red in colour." Woolgni (Dr. Jensen, No. 401). "Broad leaf type." Umbrawarra (Dr. Jensen, No. 411). "Stem like *E. papuana*." Cullen River, Woolgni and Umbrawarra (Dr. Jensen, No. 418). The leaves with insect markings, like *E. brachyandra* F.v.M. Artesian Range, North-Western Australia (W. V. Fitzgerald, No. 1358).

Between Bull Oak and Crescent Lagoon, track Cullen Creek (Prof. Baldwin Spencer); track to Cullen Creek, Katharine River, &c. (Prof. Baldwin Spencer) (with insect markings).

AFFINITIES.

1. With *E. dichromophloia* F.v.M.

The original description says that *E. latifolia* in its characters rather resembles *E. dichromophloia*, and they appear to be closest related. Both are Bloodwoods, but *E. dichromophloia* has bark of a redder cast. Both have red timbers.

The foliage of the two trees is usually very different,—that of *E. latifolia* being broad, while that of *E. dichromophloia* is narrow. Compare Plate 168 with Plate 165 of Part XL. The buds and fruits are sufficiently approximate to require care.

(Reference omitted from p. 319, Part XL) (*E. dichromophloia* and *E. corymbosa*).

It has been already observed that the large-fruited forms of *E. dichromophloia* display a good deal of similarity to *E. corymbosa*. The juvenile leaves enable us to emphasise points of difference. If we turn to Plate 161, Part XXXIX (*E. corymbosa*) we have juvenile leaves figured at 5, 6, 7*a*, and an intermediate leaf figured at 7*b*. The juvenile leaves of *E. corymbosa* are pedunculate, glabrous or with weak hairs; those of *E. dichromophloia* are sessile, stem-clasping, and scabrous. The intermediate leaves are a good deal alike, those of *E. corymbosa* being longer in proportion to the width, but the corresponding material of *E. dichromophloia* is not sufficiently abundant to speak finally.

The juvenile leaves of *E. dichromophloia* (Old Battery, Eidsvold, Q., Dr. T. L. Bancroft, September, 1919) came too late to be figured on Plate 165. They are the first I have seen, to my knowledge. I cannot do better than say that I cannot distinguish them from some of the figures of *E. setosa* on Plate 158, Part XXXVIII. They seem replicas of figs. 5 and 8, and almost as scabrous. The mature leaves of the two species are, of course, very different, but the intermediate leaves of this specimen of *E. dichromophloia* are very broad and lanceolate, as broad as those of the juvenile leaves.

2. With *E. Foelscheana* F.v.M. See p. 8.

3. With *E. corymbosa* Sm.

"*E. latifolia* has very broad even roundish leaves, and belongs, on account of its smooth bark, to the section Leiophloiæ, unless this be subject to exceptions." ("Eucalyptographia," under *E. corymbosa*.) It is not correct to say that *E. latifolia* is a member of the Leiophloiæ, although there are Bloodwoods with barks more scaly. We do not know the extent to which some of these tropical Bloodwoods vary in regard to the roughness of their barks.

DESCRIPTION.

CCXXIV. E. Foelscheana F.v.M.

In *The Chemist and Druggist of Australasia*, November, 1882.

A DWARF tree, or only of shrubby growth; branchlets robust, not angular; *leaves* scattered or exceptionally opposite, on rather short stalks, ovate or verging into a roundish form, sometimes very large, always of firm consistence, blunt or at the summit slightly pointed, greyish-green on both sides, not much paler beneath; their primary veins very divergent or almost horizontally spreading, numerous and thus closely approximated, but subtle and therefore not prominent; the circumferential vein contiguous to the margin of the leaf; oil-dots concealed or obliterated; *umbels* four to six-flowered or rarely three-flowered, forming a terminal panicle; *calyces* pear-shaped, on longish or rarely short stalks, faintly angular, not shining; *lid* not so broad as the tube of the calyx, very depressed or sometimes conspicuously raised towards the centre, tearing off in an irregular transverse line, long retained and soon reflexed from the last point of adherence; *stamens* all fertile, bent inward before expansion; *filaments* yellowish-white, some of the outer dilated towards the base; *anthers* (when fresh) almost cuneate-ovate or the inner more oblong and the outer slightly cordate, all bursting anteriorly by longitudinal slits; connective reddish, with a slight dorsal turgidity towards the summit; *style* much exceeded in length by the stamens; *stigma* not dilated; *fruit* large, urceolar, not angular; valves generally four, nearly deltoid, inserted much below the narrow edge of the fruit, at last deeply enclosed; *fertile seeds* large, terminated by a conspicuous membrane; *sterile seeds* very slender.

The species, above defined, is flowering already at the height of 18 inches (as is the case also with *E. cordata* and *E. vernicosa*), therefore, when still quite young, producing then a comparatively large cluster of blossoms; the full-grown tree seldom exceeds a height of 20 feet, and always remains of cripply stature. Stem-diameter to 9 inches, or rarely more; bark, dark grey, rough; leaves of young plants often twice, or even thrice, the size of those of old trees. (Original description.)

Mueller again described it, with slightly different verbiage, and also figured it in the "Eucalyptographia." The "Eucalyptographia" figure and description can be taken as referring to the type; they were put in hand within a few weeks after the publication of the original description.

I have measured a juvenile leaf 15 by 11 inches, and was informed that larger ones could have been collected.

It will be observed that Mueller speaks of the species as rarely exceeding a height of 20 feet, and that it "always remains of a cripply nature." In the "Eucalyptographia" he speaks of "the greatest height attained about 20 feet. Stem diameter only to 12 inches as a maximum." It attains the height of "30 feet or more" at Burrundie.

It would appear that there are variations as regards bark and leaves in this species. Until more field observations are available, let us refer to them as Form 1 and Form 2. It is probable that the two forms may be reconcilable as belonging to the same species.

Form 1. (The bark.) Description of type bark 445. (Typical of, say, 24 miles around Darwin, and therefore presumably typical of the species.)

Hard-scaly, about 1 cm. thick, in longitudinal furrows, and cracking less deeply transversely, so as to form tesseræ longer than wide, but the precise sizes of each tessera variable.

Form 2. (The bark.) Description of type bark 450. (Typical of the Stapleton district.)

This bark is thin-scaly, simply peeling off in irregular flakes of the thickness of brown paper. As compared with the bark of No. 445, that of 450 appears to be from a young, or a stunted tree.

Form 1. (The leaves.) Common in the species within, say, 24 miles of Darwin.

"Those about Darwin have smaller, thinner, and narrower leaves." (G. F. Hill.) Mr. Hill is apparently referring to leaves of the shape of fig. 4*a*, Plate 169, and he is perhaps emphasising his Nos. 344 and 445 (Darwin) too much. At the same time we must remember that those of the type are described as "ovate or verging on a roundish form." Around Darwin most of the leaves would be from second-growth plants.

The form from Darwin and near Darwin is usually found on dry, shotty ironstone or sandy loam (well drained) or on stony land (about Darwin), usually associated with *E. tetradonta*, *grandifolia*, *miniata*, and my No. 398 ("Smooth-stemmed Bloodwood"). (G. F. Hill.)

Form 2. (The leaves.) Further down the railway line, say from 34 miles to 69 miles, and probably much further. The Stapleton form (69 miles from Darwin).

"The foliage of the Stapleton specimens is denser, leaves more 'fleshy' and generally more rounded." (G. F. Hill.) This is a fair description of the typical form. Mr. Hill says that the Stapleton form grows on the flats or on the foothills very near flats, sometimes on stony country, sometimes on alluvial soil. "The Stapleton form is generally associated with the sp. represented by my 448, 449, *E. papuana*, *E. grandifolia*, and *E. terminalis*.

"*The bark of the two forms is very distinct*, as will be seen by comparing 445 and 450." (G. F. Hill.)

Lanceolar-leaved form.

We must recognise that lanceolar leaves occur in this species.

"Specimens without fruit, brought by R. Brown in 1802, during Captain Flinders' Expedition from Carpentaria, may also belong to *E. Foelscheana*, although the leaves pass into a lanceolar form." (Original description.)

Mueller amplifies these remarks in the following:—

"Some specimens without fruit, brought by Robert Brown already during Capt. Flinders' Expedition from Carpentaria, and presented to the Melbourne Botanic Museum by Sir Joseph Hooker, may belong to an extreme form of *E. Foelscheana*, although the leaves pass into a lanceolar form, and the flower-stalklets are of lesser length." ("Eucalyptographia," under *E. Foelscheana*.)

Brown's specimen is figured at fig. 1, Plate 170. It does not seem useful to give this lanceolar form a variety name, as it is a transition form, as will be seen from examination of the other figures.

RANGE.

Confined to the Northern Territory, so far as we know.

"Near Port Darwin, on sandy soil; Mr. Paul Foelsche. Found also in other northern portions of Arnhem's Land, by Mr. J. McKinlay." (Original description.) In the "Eucalyptographia," Bridge Creek, which is near Darwin (Burkitt), was added. It will be observed that I have added a number of other Territory localities, all within the tropics. It has still to be searched for in the Cape York Peninsula (Queensland) and in the Kimberley country (North-west Australia).

Western Australia.

Small fruits, broadly lanceolate leaves. Derby (C. H. Ostenfeld). I quote this specimen doubtfully, as although it simulates a small-fruited *E. Foelscheana*, the material is so imperfect that it may be a coarse form of *E. dichromophloia*. At the same time our Western Australian friends should be on the lookout for *E. Foelscheana* in the tropical portion of their State.

Northern Territory.

Huge juvenile foliage, very urceolate fruits. Near Darwin (Prof. Baldwin Spencer, W. S. Campbell, N. Holtze).

"On stony foothills and on flats at foot of hills. Associated with *E. setosa*, *E. miniata*, and Coolabah, No. 448. Timber sent, also bark, bark of trunk and branches similar throughout. Buds, flowers, fruit." Stapleton (G. F. Hill, No. 450). Inflorescence forming an open panicle. "From tree indistinguishable from 450." Stapleton (G. F. Hill, No. 452). "Tree indistinguishable from 450." Stapleton (G. F. Hill, No. 455).

"Bloodwood, rough bark on trunk and branches, *narrow-leaved form*. Small tree (see bark from trunk). Flowers about July, fruits 25th October, 1915." Darwin (G. F. Hill, No. 344). A form with *unusually narrow leaves*.

"*E. Foelscheana*. Typical of *E. Foelscheana* in vicinity of Darwin, and 20 miles south of Darwin. (Note my specimen No. 344 determined as above by you.) Sample of timber, bark, and fruit with seed." 20 miles S.E. of Darwin (G. F. Hill, No. 445). Pedicellate, *broad lanceolate leaves*.

The following is an interesting note made by Dr. H. I. Jensen, in 1916, referring to some of the above specimens :—

"344. *E. Foelscheana*, also 358, 367, 368.

"A further specimen of the broad-leaved type 368 with fruits was collected by me in December last. It was rather surprising to find that the *narrow-leaved trees* 344 and 358 were the same as 368, as the tree in "Eucalyptographia" was described as low, shrubby, and *broad-leaved*, and I know it well at Brook's Creek and Bridge Creek where I believe *Inspector Foelsche collected his type material*. In those localities it is

never, to my present knowledge, seen more than 15 feet high. It is a low scrub, found principally on clayey clay-slate and schist-flats, leaves very fleshy, flowers in huge bunches at end of branches, flowers very fleshy; pods large. The specimens at Burrundie, however, grow to a height of 30 feet or more—both *broad leaf* and *narrow leaf form*, and the tree has the appearance of the Cabbage Gum. The leaves are not as large as usual in the *scrubby form*. Wood white ant proof."

"Bastard Bloodwood. Now in flower, has rough bark to top of branches; *narrow-leaved form*. Another variety has bark like Moreton Bay Ash. Both have reddish resinous splashes on bark. Leaves similar in both." Burrundie, November, 1915 (Dr. Jensen, No. 358).

Leaves variable in size and shape, Brook's Creek; Pine and Horseshoe Creeks; Pine Creek Railway (E. J. Dunn, R. J. Winters). "Large tree." Near Pine Creek (C. E. F. Allen, No. 108). *Narrowish leaves*, open panicle.

"Tree similar to 365, 366. Terminal branches erect; leaves more rounded." 30 miles south-east of Darwin (G. F. Hill, No. 367).

"*Broad-leaved* form. Medium-sized tree; trunk covered with rough scaly bark; branches smooth, large sucker leaf." Batchelor, about 60 miles south of Darwin (Dr. H. I. Jensen, No. 368).

Mature and immature fruits. Umbrawarra (Dr. Jensen, No. 416). "On hornfels country, north of Umbrawarra, and on blocky schist country at Woolgni occurs a Bloodwood-like gum with broad leaves like *E. Foelscheana*, bark mostly smooth, but a little fine scaly bark at base like *E. papuana*, seed pods larger and urn-shaped, having a more marked rim than those of *E. Foelscheana*. Leaves, sucker leaves, wood, sent under Nos. 417, 418, 419, and 420. This tree grows on both ridges and flats, and seems variable in size and shape of pod. *E. Foelscheana* collected in same locality on a small flat, has bark all rough. Seeds without rim, otherwise similar (No. 416)." Umbrawarra (Dr. Jensen, No. 417). Fruits somewhat elongated.

"Rough bark almost to top, large fruits." McKinlay River flats (Dr. Jensen, No. 387).

Edith Creek; also Track to Katharine River, widely spread; also *coarse foliage*, fruits not large and hardly urceolate, near Katharine River (Prof. Baldwin Spencer).

"Leaf like *E. Foelscheana*, bark like *E. papuana*. Associated with *E. setosa*. Pedicellate juvenile leaves (? intermediate form). Woolgni (Dr. Jensen, No. 420). Thin juvenile leaves. Woolgni, Cullen River (Dr. Jensen, 415); thin pedicellate juvenile leaves, Cullen River, on banks (Dr. Jensen, No. 419).

Robert Brown's specimens, collected 1802–5, and distributed from the British Museum in 1876 under the labels—

(*a*) (Islands of) Gulf of Carpentaria;

(*b*) No. 4779, *E. latifolia* F.M. (*E. compacta* R.Br.), North Coast;

are *E. Foelscheana*. They are the lanceolate leaved form of the species.

AFFINITIES.

1. With *E. terminalis* F.v.M.

"*E. Foelscheana* belongs to the series exemplified by *E. terminalis*. . . . . If it was not for the great diversity of habit, *E. Foelscheana* might be approximated very closely to *E. terminalis*." ("Eucalyptographia," under *E. Foelscheana*.)

Compare Plates 164 and 165 (Part XL) for *E. terminalis*, with Plates 169 and 170, this Part, for *E. Foelscheana*. *E. Foelscheana* is a smaller, more gnarled tree, with very much coarser foliage. The fruits of *E. terminalis* are longer and narrower, usually less urceolate, or, if urceolate, more high-shouldered. Those of both species may be very large. Both have red timbers.

2. With *E. latifolia* F.v.M.

In some respects it is allied to *E. latifolia*; the leaves, however, are larger and not decurrent at the base; the petioles are comparatively shorter and, as well as the branchlets, less slender; the peduncles and pedicels are thicker and less angular; the calyces larger, not roundish-blunt at the base, and therefore not passing suddenly into a pedicel of upwards unincreased thickness; the fruit is much larger, at least twice as long as broad; and considerably contracted towards the summit, thus not almost semi-ovate; the flowers of the real *E. latifolia* are as yet unknown, and may prove different from those of the *E. Foelscheana*, though their anthers, seen as remnants, show the same form." (Original description.)

He repeats these observations in almost the same words, and adds "A few adherent anthers of *E. latifolia* do, however, exhibit the same form. These two species hold almost the same relation to each other as *E. urnigera* to *E. cordata*" ("Eucalyptographia" under *E. Foelscheana*).

Compare Plates 168 and 169. *E. Foelscheana* is a very much coarser species than *E. latifolia*, as regards its inflorescence and fructification. The former species shows greater extremes of size in leaves than does the latter; I have not seen huge leaves nor lanceolar ones in *E. latifolia*. The fruit of that species is smaller, less urceolate, the orifice smaller, and has slenderer peduncles and pedicels.

3. With *E. setosa* Schauer.

The affinities with this species are less close. Compare Plate 158, Part XXXVIII, for fruits of *E. setosa*, which are large, and frequently of the same shape as those of *E. Foelscheana*, but those of the latter are always glabrous. The leaves of the two species are very different, while *E. setosa* is often a moderately large, umbrageous tree.

DESCRIPTION.

CCXXV. E. Abergiana F.v.M.

In *Fragm.* xi, 41 (1878).

Shortly afterwards Mueller redescribed it in English in the "Eucalyptographia" with a Plate. The "Eucalyptographia" description so nearly follows the original that it may be stated here as equivalent to it.

Finally very tall; *leaves* scattered, of thick consistence, oval or elongated-lanceolar, *hardly inequilateral, shining above, opaque beneath; the lateral veins copious subtle and very spreading*, the longitudinal vein almost contiguous to the margin of the leaves, or but slightly removed from the edge; *panicles terminal*; flower-stalks thick, almost cylindrical, the ultimates bearing 2–6 flowers on exceedingly short or *without stalklets*; calyces pale, their tube truncate-ovate, nearly twice as long as the almost hemispheric lid, not angular; stamens all or nearly all fertile, inflexed before expansion; anthers oval, with nearly longitudinal dehiscence; stigma very slightly dilated; *fruits large, oval-urnshaped*, smooth, with a thin margin and with four enclosed at first horizontal valves; fertile seeds expanding from their summit into a long membrane, much longer than the slender sterile seeds.

On the mountains, near Rockingham Bay; Dallachy.

A lofty tree, with persistent bark and very expanding branches. *Heart-wood* very hard, reddish. *Branchlets* in some instances slender and somewhat angular, in other cases thick and cylindrical. *Leaf-stalks* $\frac{3}{4}$–$1\frac{1}{2}$ inches long. *Leaves* measuring $2\frac{1}{2}$–4 inches in length or occasionally longer, rarely shortened to an almost oval form, 1–2 inches broad, often very gradually narrowed upwards, blunt at the base. *Panicle* almost corymbous; its ultimate flower-stalks generally about 1 inch long, as well as the branchlets, pale, not shining. The *unopened calyces* egg-shaped, their very blunt and rather thick lid rather separating by a horizontal rupture than by a well-defined suture of circumcision; the tube in flowering state about $\frac{1}{2}$ an inch long, sometimes subsequently slightly turbinate. A few of the outer stamens occasionally devoid of anthers; filaments, according to the note of the collector, whitish in a fresh state, but reddish-yellow when dry; the longer filaments 4–5 lines long. *Anthers* hardly $\frac{1}{2}$ a line long; their cells separated by a broad connective. *Style* half-included within the calyx, exceeded by the stamens. *Fruit* 1 inch long, or somewhat longer, not angular; the valves deltoid-shaped, hardly $\frac{1}{8}$ inch long. *Fertile seeds* very compressed, terminated by a semi-oval membrane, giving a length of about $\frac{1}{3}$ inch for the whole seed, including the appendage.

In the "Eucalyptographia" it is stated to be "a lofty tree with persistent bark and very expanding branches," and with reddish timber. I do not know of any tree belonging to this species which may be called "lofty" or "stately" (*loc. cit.*), but the species is very little known, and should be further investigated.

RANGE.

The type came from the Coast Range near Rockingham Bay, Queensland, near 18 deg. south latitude, and we do not certainly know it from any other locality.

QUEENSLAND.

"Tree 15 or 20 feet high, rough bark." Coast Range, Rockingham Bay (J. Dallachy). The type.

AFFINITIES.

1. With *E. ptychocarpa* F.v.M.

"Approaches to *E. ptychocarpa*, with which it agrees in the size and shape of its fruit, but the latter is in no way lined with prominent longitudinal ridges, nor are the flowers provided with conspicuous stalklets." ("Eucalyptographia," under *E. Abergiana*.)

These ridges sharply separate the two species, which will be further compared when *E. ptychocarpa* is dealt with.

2. With *E. miniata* A. Cunn.

"This species differs from *E. Abergiana* in narrower leaves, opaque on both sides, axillary solitary flower stalks, longitudinally angular calyces, longer anthers, larger fruits and seeds without any appendage." ("Eucalyptographia," under *E. Abergiana*.)

For *E. miniata*, see Plate 96, Part XXII. The obvious differences are elongated ribbed fruits of *E. miniata* rarely urceolate as in *E. Abergiana*. The ribbing extends to the buds. The coarse inflorescence is sessile as to pedicels in both species.

3. With *E. Watsoniana* F.v.M.

"*E. Watsoniana* again recedes in narrower leaves, equally coloured on other side, calyces with a varnish lustre and fixed to distinct stalklets, a widely dilated lid which over-reaches the orifice of the calyx-tube, longer stamens, fruits wider at the summit with a furrowed broader rim and unappendiculated seeds." ("Eucalyptographia," under *E. Abergiana*.)

The differences of these two species will be dealt with in the next Part (under *E. Watsoniana*).

4. With *E. corymbosa* Sm.

"*E. corymbosa*, which likewise occurs as far north as Rockingham Bay, is separated from *E. Abergiana* by its narrower leaves, acute at the base, angular and more slender flower-stalks, smaller calyces provided with stalklets and not pale-coloured, a thinner and not obtuse lid, which separates by a distinct suture of the calyx, smaller fruits, more contracted upwards, and the lesser appendage of the seeds." ("Eucalyptographia," under *E. Abergiana*.)

And again " If it were necessary to point out any differences of *E. corymbosa* and *E. Abergiana*, we need only allude again to the colour of the stamens; —besides *E. corymbosa* has its flowers and fruits smaller, the seeds wholly or nearly destitute of any appendage, and the seedlings purplish-hispid, with short-stalked elliptic opposite leaves; while *E. Abergiana* is still further removed by the want of stalklets of its flowers and by the larger and wider lid, although the seeds are here again conspicuously appendiculated." (" Eucalyptographia," under *E. ficifolia*.)

For *E. corymbosa* see Plates 161 and 162 in Part XXXIX. In that species, pedicels are present and the peduncles more slender. The buds and fruits are smaller and less coarse; the fruits of *E. Abergiana* are less urceolate and the rims thicker. The foliage of *E. Abergiana* is coarser.

5. With *E. terminalis* F.v.M.

" *E. terminalis* is distinguished in a similar manner from *E. Abergiana* as *E. corymbosa*, except the seeds, but besides in the paler foliage, the leaves being of equal colour on both sides, necessitating stomata on each, and not merely on the underside as in *E. Abergiana*; thus also the latter, like all the species with only hypogenous stomata, forms a more shady tree, its leaves expanding more horizontally, whereas *E. terminalis*, like the majority of its congeners, turns its leaves more vertically." (" Eucalyptographia," under *E. Abergiana*.)

Let us turn to Plate 164, Part XL, as regards figures of *E. terminalis*. *E. terminalis* (so far as we know) is the larger tree; *E. Abergiana* is stockier, and with thicker, coarser foliage. *E. Abergiana* has very short pedicels or none, while the fruits of *E. terminalis* are cylindroid rather than urceolate.

6. With *E. calophylla* R.Br.

" *E. Abergiana* can be separated from *E. calophylla* and *E. terminalis* by the want of stalklets of its calyces, and from the latter besides by the broader and above dark-green leaves." (" Eucalyptographia," under *E. corymbosa*).

This will be referred to when *E. calophylla* is reached.

DESCRIPTION.

CCXXVI. E. pachyphylla F.v.M.

In *Journ. Linn. Soc.* iii, 98 (1859).

THE description may be translated in the following words :—

Shrubby, with angular young branches, and alternate leaves on moderately long petioles, thickly coriaceous, ovate, or lanceolate-ovate, acuminate, hardly unequal-sided, not perforate, finely penniveined, the peripheral vein remote from the margin; with axillary umbels irregularly 3-flowered, the peduncles and pedicels very short. Flowers not known. *The tube of the fruiting-calyx depressed-hemispherical,* with four distinct ribs and more indistinct ones, with raised margins, the capsules 4- to 5-celled, convex at the top, with somewhat exserted valves, the fertile seeds with narrow wings, rather light-coloured.

Hab. In a sandy desert at Hooker's Creek (Northern Territory). Flowering time, autumn.

Shrub of the height of a fathom or slightly higher. Leaves mostly 1½ to 2½ inches long, opaque in dry specimens. Flowers not known. Fruits 6 to 8 lines in diameter, the margin just produced above the valves. Fertile seeds with the wings added 1½ lines long. Near to *E. alpina.*

It will be observed that the flowers were unknown to the original describer, and that the "peduncles and pedicels (are) very short."

It was then described by Bentham in B.Fl. iii, 237. *Inter alia* the fruits are described as *nearly sessile.*

Then Mueller figured it in "Eucalyptographia," but the plate, as regards the flowering and fruiting twig, is made up of more than one plant; in other words it is in part an accidental fake. The material of this species in the Melbourne Herbarium had in course of years, from Mueller's time onwards, become a good deal mixed up. Recently Prof. Ewart forwarded the whole of it to me for examination. I am satisfied that in the "Eucalyptographia" plate the leaves and fruits belong to the type, although a peduncle is not shown and the pedicels are shown too long (see figs. 1 and 2, Plate 171, of the present work).

The buds and flowers in the "Eucalyptographia" plate do not belong to the type. They really came from Glen of Palms, Macdonnell Range (E. Giles).

Then come my notes on the species in *Proc. Roy. Soc. N.S.W.*, lii, 507 (1918), from which the following notes are extracted :—

In Ewart and Davies' "Flora of the Northern Territory," p. 306 (1917), I indicated that I believe this is a valid species, and that my *E. pyriformis* Turcz., var. *minor* (present work, Part XVII, pages 232 and 235) should merge in it. I desire to draw attention to this species, which is in some confusion.

Bentham, as stated, described the species, but he pointed out the inadequacy of the material, and even doubted if it should be given specific rank. In Fragm. x, 5 (1876), Mueller recorded it from Glen of Palms, Macdonnell Range, Northern Territory (E. Giles), and described the flowers (5–7 and nearly sessile) for the first time. He indicated its true affinity to *E. pyriformis.*

Mueller then figured the species in his " Eucalyptographia," and as usual he missed the opportunity of figuring the type.

From Tanami, western Northern Territory (Dr. H. I. Jensen, No. 206, 1914), I have received both *E. pachyphylla* (resembling No. 371) and a small-flowered *E. pyriformis* under the same number, and undoubtedly the species are closely related.

Mueller's " Eucalyptographia " plate of this rare species is misleading to the extent that it will cause most people to think that it correctly depicts his *E. pachyphylla.* As a matter of fact, it shows a multiflowered, pedicellate form. To put botanists on their guard, I considered it at one time desirable to indicate the plant figured by Mueller as var. *pedicellata.*

SYNONYMS.

1. ***E. pyriformis*** Turcz., var. ***minor*** Maiden (in part).

2. ***E. pachyphylla*** F.v.M., var. ***pedicellata*** Maiden.

1. *E. pyriformis* Turcz., var. *minor* Maiden in part. This work, Part XVII, p. 230, also Plate 75, figs. 5 and 6 (figs. 7*a* and 7*b* are *E. Oldfieldii* F.v.M.).

There was an unfortunate mix-up of material in the Melbourne Herbarium shortly after Mueller's death, referred to at p. 12.

2. *E. pachyphylla* F.v.M., var. *pedicellata* Maiden in *Proc. Roy. Soc. N.S.W.*, lii, 508 (1918).

Misled by the original description (*a*) of the peduncles and pedicels as very short, (*b*) of Bentham's description of the fruits as " nearly sessile," (*c*) by Mueller's description of the flowers of the Glen of Palm specimens as " nearly sessile " (having seen them I would call them " sessile "), but particularly by (*d*) the upper part of the " Eucalyptographia " plate, where Mueller shows two clusters of buds and flowers sessile (the cluster of fruits has exaggerated pedicels), I looked upon the normal form as sessile, and, therefore, a form with pedicels as worthy of a varietal name, *pedicellata.* I now find that the normal state of the species is pedicellate, so that the variety *pedicellata* must fall, while a variety *sessilis* has been proposed at p. 14.

VARIETY.

Var. *sessilis* var. nov.

I have already shown that confusion has arisen in regard to the presence or absence of pedicels in this species. The pedicellate (normal) and non-pedicellate forms should, however, be distinguished by a name, and therefore I propose the name *sessilis* for the latter. The specimens, Glen of Palms, Macdonnell Range, Northern Territory (E. Giles), may be taken as the type of the proposed variety (see figs. 4*a* to *c*, Plate 171).

RANGE.

(Of normal form, *i.e.*, with pedicellate inflorescence.)

NORTHERN TERRITORY.

The sheet in Herb. Melb. labelled "*E. pachyphylla* Ferd. Mueller, Hooker's Creek, Dr. M." and which refers to the type, consists of two leaves, together with loose pedicellate fruits, evidently the same as those figured in the "Eucalyptographia" plate, but with shorter pedicels than figured therein. See figs. 1*a*, 1*b*, Plate 171. They belong to the type. (I would again remind my readers that the buds and flowers shown on the "Eucalyptographia" plate do not belong to the type.)

Small tree of 10 feet. Tanami, western Northern Territory, collected by Dr. H. I. Jensen (C. E. F. Allen, No. 206). Flowers only, shortly pedicellate. It is difficult, and perhaps impossible, to separate these flowers from those labelled "Sources of the Georgina River."

QUEENSLAND.

"*E. pachyphylla*, F.v.M.," Pituri Creek, a tributary of the Georgina River, Western Queensland (Alfred Henry, 1889). A few fruits only. See fig. 2, Plate 171. The fruit is a little smaller than that of the type.

Linda Creek. [I cannot trace this. Can it be the same as Lander Creek, a few lines below?] One fruit only. Shortly pedicellate; fig. 3, Plate 171. As compared with the type, this is of greater diameter and with more ribs on the calyx-tube.

The following in fruit only :—

A. "Interior of S.A." (doubtless Northern Territory). Figured at 5*a* and 5*b*, Plate 75.

B. 60 miles west of Camp IV, Lander Creek, Northern Territory, 22nd June, 1911 (G. F. Hill, No. 371).

Sessile, single, large-fruited form. A specimen in leaf and flower only, labelled by Mueller "*E. pachyphylla* F.v.M. (Strongylantheræ), W. H. Cornish, 1885," precisely matches the flowering specimen (Glen of Palms, *E. Giles*) in the "Eucalyptographia" plate. Figured at 6*a*-6*d*, Plate 75. This is the plant referred to as from the Mulligan River, Western Queensland, this work, Part XVII, p. 235.

RANGE (of var. *sessilis* var. nov.).

NORTHERN TERRITORY.

"W. Austral. Expedition, Glen of Palms, E. Giles, 1872," in Luehmann's writing. "*E. pachyphylla* F.M." in Mueller's writing.

These specimens are in flower and bud only, are sessile, and are interesting because in *Fragm.* x, 5 (1876), Mueller first described the flowers (5–7 and nearly sessile) from them. I look upon them as quite sessile, and they are depicted in Mueller's "Eucalyptographia" plate (flowers and buds only).

Glen of Palms is on the Finke River, just south of the Krichauff Range. It formed Camp 44, Horn Expedition. In the report of this Expedition, Botany, by Prof. R. Tate, at p. 158, he records Giles' specimen, and also Krichauff Range (Kempe), a specimen to be presently referred to; also gorge of Reedy Creek, ravine on south side of Mt. Tate, on Mt. Sonder, all localities in the Macdonnell Ranges.

The Rev. H. Kempe, the collector above referred to, was located at the Moravian Mission Station, Hermannsburg, on the northern side of the Finke River, and about 1 mile north of the Krichauff Range. It was abandoned as a Mission Station in the early "nineties." See Report, Horn Exped., p. 48. There is a survey of the Station and its surroundings in Mr. C. Winnecke's Report of the Expedition.

Immature (some slightly glaucous) fruits, Finke River (Kempe, 1880), are, as regards some of them, very fairly represented by 6*b*, Plate 75; fruits immature, but a little more advanced are figured herewith.

Here we have a small fruited form. Leaves and ripe fruits, Finke River (Revd. W. Schwarz, 1886) are figured herewith. Mueller does not appear to have referred to these specimens anywhere.

15 miles west of Hugh River (a tributary of the Finke River), Macdonnell Ranges, N.T., 6th May, 1911 (G. F. Hill, No. 147). Glaucous early fruits, 40 miles west of Camp IV, Lander Creek, N.T. 21st June, 1911 (G. F. Hill, No. 361). Flowers with most of the stamens dropped.

Still in the Macdonnell Ranges, at p. 35 of the Horn Expedition Report, we have "June 17, 1894, Horn Exped., Camp 33, Deering Creek, height 2,210 feet. Travelled over sandridges covered with . . . . and Mallee (*Eucalyptus pachyphylla*)."

"Bush, 8–12 feet high, on sand plain 9 miles N.E. of the permanent water of Winnecke's on the Marshall." (Lieut. Dittrich.)

Luehmann's label is "N. of McDonnell Range, Plenty River, Marshall River, Milne River, Lake Nash (Lieut. Dittrich, 1886)." Mueller labelled it *E. pachyphylla.*

Plenty River near S. lat. 23, unites with the Sandover River to form the Marshall or Hay River (N.T.). The Milne River runs into the Herbert River near the Northern Territory–Queensland boundary in 21° S. lat. Lake Nash is near the Northern Territory–Queensland border near 21° S. lat. 138° long. The material consists of a few loose buds and fruits, buds with pedicels on short peduncles, and with sharply pointed opercula and sharp, almost winged ribs, sharper than figured in Plate 75 or in the "Eucalyptographia." The fruits (fig. 6, Plate 171) sessile. (These fruits very well match the sessile flowers figured in the "Eucalyptographia.")

QUEENSLAND.

Labelled *pachyphylla* by F.v.M. :—

1. Sources of the Georgina River (Lieut. Dittrich, 1886). Flowers and buds only.
2. Dense bushes, 10–15 feet high, Spinifex sand plains, 27 miles west of the Rankin River, lat. 20° 27′ 24″ :—
   - (*a*) Flowers with short pedicels and moderately ribbed opercula very pointed.
   - (*b*) Buds, with label (as above), but buds rather more pedicellate.

Both (*a*) and (*b*) show how difficult it is to frame a character on the length of the pedicel. They certainly connect with the Tanami specimens.

The Georgina River of Western Queensland has its principal source in the Barkly Tableland, and receives the Lorne and Rankin's Creeks from the Northern Territory. In the "New Atlas of Australia" (1886), the Rankin and the Lorne are shown as the same stream, in 20–21° S. lat., near the Queensland border.

These Queensland specimens collected by Lieut. Dittrich in 1886, for Mueller, were obtained near the Northern Territory–Queensland border, and on the same trip as those collected by the same traveller and recorded under Northern Territory. Arranging them geographically under two States is merely a matter of convenience.

AFFINITIES.

1. With *E. alpina* Lindl.

"Near to *E. alpina*" (original description). (See Part IX, Plate 41, for *E. alpina.*) The anthers of the two species are totally different. *E. alpina* is a rather broad-leaved small tree of mountain tops of a restricted range in Victoria. The buds and fruits of *E. alpina* may be described as warted; the ridges, where present, are not as well defined as in *E. pachyphylla.* The fruits are different, though sometimes possessing a resemblance.

2. *E. cosmophylla* F.v.M.

" In some respects they " (the imperfect specimens of *E. pachyphylla*) " resemble *E. cosmophylla* and its allies, but the fruit, the seeds, and perhaps the inflorescence are different (B.Fl. iii, 237). Let us turn to Part XXI, Plate 91, for *E. cosmophylla*. In *E. cosmophylla* the flowers are usually in threes, and the calyx-tubes have usually one rib and the opercula none at all. The fruits differ a good deal, and the anthers still more. *E. cosmophylla* attains the size of a fairly large tree.

3. With *E. pyriformis* Turcz.

This was first indicated by Mueller in *Fragm.* x, 5.

" *E. pachyphylla* approaches the variety *pruinosa* of *E. pyriformis* [such a variety has never been technically defined.—J.H.M.], but its flowers and fruits are much smaller, almost devoid of a general flower stalk (peduncle), and crowded to the number of about seven together (" Eucalyptographia " under *E. pyriformis*). For *E. pruinosa* Turcz., see this work, Part XVII, pp. 230–1. I have not seen the species, but Mueller says *E. pachyphylla* only " approaches " it.

There seems no doubt that both Mueller and I are correct in pointing out the affinity of *E. pachyphylla* to *E. pyriformis*, and I went so far as to make the former a variety of the latter. Compare figures 5 and 6 (*E. pachyphylla*) with the rest of the figures on Plates 75 and 76 (*E. pyriformis*). The anthers are similar, and the chief differences lie in the size of the fruits and in the length of calyx-tube or at least pedicel.

4. With *E. pyriformis* Turcz., var. *Kingsmilli* Maiden.

The affinity of *E. pachyphylla* is, however, closer to this variety, but they differ, as regards the larger buds and fruits; the longer petioles and pedicels; the more pointed opercula; the ribs deeper, almost winged and more numerous, of var. *Kingsmilli*.

5. With *E. Oldfieldii* F.v.M.

E. Oldfieldii is under revision, but Part XVII, p. 223, may be turned to, and figs. 11, Plate 73, and figs. 1 and 2, Plate 74, consulted. All these are close to the type. Both species are Mallees, but in *E. Oldfieldii* the fruits are in threes, with no ribbing on either calyx-tube or operculum, and the rim of the fruit is domed.

Fig. 7, Plate 75 (Burracoppin), which I attributed to *E. pyriformis* var. *minor* (and specifically identical with *E. pachyphylla*), of which fruits and a few leaves are alone available, is a form of *E. Oldfieldii*, with comparatively long stout pedicels. I have a note on it in *Journ. Roy. Soc. N.S.W.*, li, 455.

DESCRIPTION.

CXIV. E. pyriformis Turczaninow.

THE following new variety, originally published in *Proc. Roy. Soc. N.S.W.*, lii, 508 (1918), is figured in the present work for the first time (see also p. 229, Part XVII).

E. pyriformis Turcz., var. *Kingsmilli* Maiden.

A shrub, or small tree attaining a height of about 20 feet, with rough bark on the trunk, the upper branches being smooth. The crimson flower-buds give the tree a most ornamental appearance.

Juvenile leaves (not seen in their earliest stage, *i.e.*, not quite opposite, but earlier than I have ever seen them in any form of *E. pyriformis*) narrow-lanceolate, say 4–6 cm. long and 1 cm. in the widest part, with petioles of about 1 cm. Equally pale green on both sides, venation not conspicuous, the secondary veins at an angle of about 45° with the midrib.

Mature leaves apparently not different from those of the normal form of *E. pyriformis*.

Flowers in an umbel usually of three, with a rounded or flattened peduncle of about 4 cm., with pedicels of half that length. Anthers as in *E. pyriformis*. Buds with calyx-tubes nearly hemispherical and about 2 cm. in diameter. The operculum continued into an almost pungent point. Both calyx-tube and operculum covered with about eight thin prominent wings, about 4 mm. deep, giving the buds a remarkable appearance. The style about 1·5 cm. long, persistent, with the stigma of scarcely increased diameter.

Disc at first concave, with a sharp raised inner ring flush with the top of the calyx-tube, which continues to grow upward, and at the same time expanding outwards, completely absorbing the concave cavity (noted in the early stages of its growth), until it reaches a height of 3–4 mm. above the level of the truncate calyx rim.

Fruit nearly hemispherical, 2·5 cm. in diameter, with eight prominent wings; these and the remainder of the calyx-tube (calycine rim) raised about the staminal ring.

This bizarre and showy variety, which promises to be an interesting addition to gardens in semi-tropical districts of low rainfall, is named in honour of the Hon. William Kingsmill, M.L.C., who has for many years taken a most active interest in forestry matters in Western Australia, and who has frequently assisted my botanical work for that State.

RANGE.

Confined to Western Australia as far as we know.

From the East Murchison to Lake Way. The type from close to a mining camp called Mount Keith, about 160 miles north of Leonora (W. Kingsmill, July, 1918).

I subsequently received the following specimen from the National Herbarium, Melbourne (Prof. Ewart). "Bush of 10 feet." Upper Ashburton River (W. Cuthbertson, 1888). This is the variety *Kingsmilli* but with peduncles and pedicels shorter and fruits smaller than in the type.

AFFINITY.

With *E. pachyphylla* F.v.M. (see p. 17).

DESCRIPTION.

XCII. E. Oldfieldii F.v.M.

In *Fragm.* ii, 37 (1860).

FOLLOWING is a translation of the original :—

A shrub, *leaves* alternate with rather long petioles, ovate or narrow lanceolate, thick, coriaceous the same colour on both sides, slightly curved, imperforate, faintly and spreadingly veined, *peripheral vein* fairly distant from the edge, *umbels* shortly pedunculate, 2- or 3-flowered, the almost hemispherical *operculum* narrowed into a short umbo slightly longer than the semi-globular tube of the subsessile calyx, the very convex top of the *fruit* broadly encircling the capsule, *calyx-tube* exangular, hemispherical, the vertex of the 3- or 4-celled *capsule* pyramidal and exsert, seeds without wings.

In sandy plains near the Murchison River—A. Oldfield.

A shrub 4–5 feet high. Bark red, with loose flakes. Branchlets angled, the older ones terete. *Leaves* shining, 2½–5 inches long, ½–1½ inches broad at the lower part. *Peduncles* 1½ up to a few lines long, thickened at the base. *Buds* 4–5 lines long, wrinkled. Fruits not broader than ½ inch; *tube* hemispherical, margin 2 lines broad. Valves or either the exsert part of the *capsule* itself 1½ lines long, almost deltoid. *Seeds* sterile, ⅔–1 line long; the fertile ones hardly more than a line long and blackish.

It was described in English by Bentham in B.Fl. iii, 237, and figured and described by Mueller in his " Eucalyptographia."

Notes supplementary to the description.

It has an ovoid operculum usually more or less rostrate. Its juvenile foliage is petiolate and ovate, not broad, with the intramarginal vein distinctly removed from the edge. I have not seen it in its earliest stage.

It is a stiff shrub of 8 or 10 feet, with many thin stems close together, forming an impenetrable scrub, but not a true Mallee. It is not a timber tree.

The anther will be found figured at fig. 9, Plate 171. It will be seen that it is practically identical with that of *E. pyriformis* (fig. 9, Plate 171), belonging to a group named by Mueller Strongylantheræ.

RANGE.

It is confined to Western and South Australia. Mueller ("Eucalyptographia") gives its range as from Champion Bay to the Murchison River in Western Australia, but the localities about to be quoted show that it extends to the Eastern gold-fields and to the South Australian border.

For a number of Western Australian localities, see Part XVII, p. 223, of the present work. It is a species often obviously passed over as "Mallee," and we require additional localities in order to properly map out its distribution.

WESTERN AUSTRALIA (ADDITIONAL LOCALITIES).

About 4 miles north of Menzies (C. E. Lane Poole, No. 282).

Bruce Rock to Merriden (Dr. F. Stoward, Nos. 16, 36). "Mallee," Tammin (C. H. Ostenfeld, No. 512). Comet Vale (J. T. Jutson, Nos. 242, 250).

SOUTH AUSTRALIA.

"Camp 10, S.A., Elder Exploring Expedition. 27th June, 1891. 15 feet high." (R. Helms.) On the official map it is stated that some Mallee was found in the vicinity of this camp, which is in South Australia, in, say, 27° 60′ S. lat. and 131° long. E.

AFFINITIES.

1. With *E. Drummondii* F.v.M.

"The close affinity of *E. Oldfieldii* to *E. Drummondii* remains to be noted. So far as I can judge from Drummond's specimen No. 86, no other discrepancies of the latter exist than the smaller size of the leaves, flowers and young fruits, and the comparatively greater length of the flower-stalks and stalklets; but such differences are not in every other case of specific value, and as the bud and ripe fruit remained hitherto unknown, the final settling of this question is not yet possible. If *E. Drummondii* should prove a mere variety, as seems likely . . . ." ("Eucalyptographia," under *E. Oldfieldii*.)

E. Oldfieldii differs from *E. Drummondii* in the sessile inflorescence which is arranged in triads (or when pedicellate), the pedicels are very stout and shorter than those of *E. Drummondii*) and in different shaped buds and fruits, as will be seen by comparing Plate 73 (fig. 11) and Plate 74 (figs. 1 and 2) for *E. Oldfieldii* with Plate 74 (figs. 3, 5, 6, 7, 9, 10) for *E. Drummondii*. The former is a Mallee, and the latter a small tree.

2. With *E. Ewartiana* Maiden, in *Proc. Roy. Soc. N.S.W.* liii, p. 111 (1919).

This will be dealt with when *E. Ewartiana* is reached.

Additional affinities have been dealt with in Part XVII, p. 225.

DESCRIPTION.

CCXXVII. E. Drummondii Bentham.

In B.Fl. iii, 237 (1866).

Leaves from ovate oblong to lanceolate, obtuse or acuminate, under 3 inches long, very thick, with very fine close parallel veins, very diverging or almost transverse, but scarcely conspicuous, the intramarginal one close to the edge. *Peduncles* axillary or lateral, ½ to 1½ inches long, terete or nearly so, each bearing an umbel of 3 to 6 rather large flowers on terete pedicels often ½ inch long. *Calyx-tube* broadly hemispherical, hard and smooth, 4 to 5 lines diameter. *Operculum* conical, rather broader and considerably longer than the calyx-tube. *Stamens* about ½ inch long, inflected in the bud; anthers rather small, ovate, with distinct parallel cells. *Disk* very broad, nearly flat, forming a prominent ring round the ovary, of which the obtusely conical centre protrudes about 1 or 1½ lines above the disk at the time of flowering. *Fruit* unknown.

The fruit was unknown to Bentham when he described *E. Drummondii* in B.Fl. iii, 237, and apparently Mueller only saw the young fruits. They will be found at fig. 7, Plate 74. Juvenile foliage petiolate, ovate, intramarginal vein close to edge (specimens of O. H. Sargent, near York, W.A.), but neither it nor the anthers figured until figs. 10–12, Plate 171, of the present part.

SYNONYM.

E. Oldfieldii F.v.M., var. *Drummondii* Maiden, at Part XVII, p. 223, of the present work.

Mueller, in "Eucalyptographia," under *E. Oldfieldii*, uses the following words:—

So far as I can judge from Drummond's specimen No. 86, no other discrepancies of the latter (as regards *E. Oldfieldii*) exist than the smaller size of the leaves, flowers and young fruits, and the comparatively greater length of the flower stalks and stalklets, but such differences are not in every case of specific value, and as the bud and ripe fruit remained hitherto unknown, the final settling of this question is not yet possible. If *E. Drummondii* should prove a mere variety, as seems likely . . . .

Mueller continued to hold the opinion that *E. Drummondii* was not distinct from *E. Oldfieldii*, for he omitted it from his *Census*. Luehmann (*Proc. Aust. Assoc. Adv. Science*, vii, 532, 1898) writes: "*E. Drummondii* seems a variety of this (*E. Oldfieldii*), being smaller in all its parts."

After consideration, in Part XVII of the present work, I constituted *E. Drummondii* as a variety of *E. Oldfieldii* as already stated, adopting Drummond's No. 86 (the type of *E. Drummondii*) as the type for the variety. I am now of opinion that *E. Drummondii* is a valid species.

RANGE.

It is confined to Western Australia. As in the case of so many other of Drummond's specimens, we do not know precisely their localities, but inasmuch as it has only been certainly found since from the York district, we have an indication of Drummond's locality, and I would urge systematic search for the species. Local observers are now aware that it has long been confused with *E. Lane-Poolei* (a species to which it is more closely related than *E. Oldfieldii*), and this should facilitate search.

Drummond's No. 86. The inflorescence varies in size somewhat in various specimens. Figured at 3 and 6, Plate 74.

The following specimen matches the type absolutely :—

Small tree of about 20 feet. Trunk and branches smooth, whitish buff, with a few brown semi-detached scales of dead bark. Leaves dull green. Growing in light, humous soil, mixed with ironstone gravel. Cut Hill, York (O. H. Sargent, No. 266). (Figured at 5 and 7, Plate 74.)

Also St. Ronan's Well, near York (C. E. Lane Poole).

The following specimens have been examined :—

No. 86 (Drummond). Herb. Cant. and Herb. Oxon. The former in bud (one), but mostly early fruit. The latter mostly in bud and flower, and a little early fruit.

AFFINITIES.

1. With *E. Oldfieldii* F.v.M. See p. 21.
2. With *E. Lane-Poolei* Maiden, in *Proc. Roy. Soc. N.S.W.* liii, p. 107, (1919).

   This is its closest affinity, and will be dealt with when *E. Lane-Poolei* is reached.

Explanation of Plates (168-171).

PLATE 168.

E. latifolia F.v.M.

1. Juvenile orbicular leaf. Not quite in the alternate stage, but the youngest leaf I have seen. Bathurst Island, Northern Territory. (G. F. Hill, No. 464.)

2*a*. Mature leaf; 2*b*, large corymbose panicle, showing buds, flowers, and very young fruits; 2*c*, front and back views of anther; 2*d*, fruits of varying size and shape. Bathurst Island. (G. F. Hill, No. 469.)

3. Immature fruit, markedly urceolate. Pine Creek, Northern Territory. (Dr. H. I. Jensen, No. 357.)

4. Mature and starved fruits. Between Bull Oak and Crescent Lagoon, Darwin to Katharine River. (Prof. W. Baldwin Spencer.)

5. Mature fruits with remarkably slender peduncles and pedicels; the leaves comparatively small. Darwin to Roper River. (Prof. W. Baldwin Spencer.)

6*a*. Mature leaf; 6*b*, immature fruits. McKinlay Flats, Northern Territory. (Dr. H. I. Jensen.)

PLATE 169.

E. Foelscheana F.v.M. (See also Plate 170.)

1. (At back), portion of a large juvenile leaf (the original is 15 by 11 inches, and even larger were seen). Katharine River, Northern Territory. (Prof. W. Baldwin Spencer.)

2. Small, scarcely urceolate fruits, attached to a mature leaf 20 to 16 cm. Katharine River. (Prof. W. Baldwin Spencer.)

3*a*. Mature leaf; 3*b*, immature buds; 3*c*, immature fruit. McKinlay River Flats. (Dr. H. I. Jensen.)

4*a*. Twig, bearing buds and flowers; 4*b*, front and back views of anthers; 4*c* and 4*d*, fruits, views end-on and in elevation. Darwin (correspondent of Mueller).

5. Mature fruits of the large or typical form, near Darwin. (Prof. W. Baldwin Spencer.)

6*a*. Mature leaf; 6*b*, unusually oblong leaf; 6*c*, small, mature fruit. Track to Katharine River. (Prof. W. Baldwin Spencer.)

PLATE 170.

E. Foelscheana F.v.M. (See Plate 169.)

(The lanceolar-leaved form.)

1. Twig with long lanceolar leaf and flat-topped opercula (compare fig. 4*a*, Plate 169). "North Coast" (Northern Territory). Robert Brown, "Iter Australiense, 1802–5."

2*a*. Twig with shorter lanceolar leaf and fruits; 2*b*, fruit, end view. Darwin (correspondent of Mueller, by whom the specimen was sent to the Calcutta Herbarium).

3*a*. Small lanceolar leaf, comparable in size and shape with that of 6*a*, Plate 169. (Note the straight insect markings, parallel to the secondary veins. They have also been observed in *Eucalyptus brachyandra* F.v.M., but apparently not previously recorded); 3*b*, small fruits; 3*c*, winged seeds. Between Cullen River and Woolgni, Northern Territory. (Dr. H. I. Jensen, No. 418.)

The lanceolar-leaved form of this species is referred to at pp. 5 and 6. It would appear that a variety name for this form would not be justified in the present state of our knowledge, for comparing Plates 170 and 169, it will be observed that there is much variation in the shape of the leaves of the species. Further, if the fruits be compared, *e.g.*, the small fruits, fig. 3*b* (Plate 170) with the small fruits 2 (Plate 169), and the large fruits, fig. 2*a* and 2*b* (Plate 170) with the large fruits of fig. 5 (Plate 169), it will be seen that small and large fruits occur in both the typical and lanceolar-leaved forms.

PLATE 170—*continued.*

E. Abergiana F.v.M.

4*a*. Twig with leaf, buds, and flowers; 4*b*, fruit, with a very short pedicel, from the drawing of the type in Mueller's "Eucalyptographia."

5*a*. Mature leaf (rather broader than any leaf depicted by Mueller's artist); 5*b*, immature bud; 5*c*, anthers in different positions; 5*d*, fruit (rather more sessile than depicted by Mueller's artist). Rockingham Bay, Queensland. (J. Dallachy.) Both 4 and 5 drawn from the type.

PLATE 171.

E. pachyphylla F.v.M.

1*a*. Leaf; 1*b*, fruit. Hooker's Creek, Northern Territory. (Mueller.) Type of the species (N.B., the fruits drawn in "Eucalyptographia" have the pedicels too long and the peduncle is not shown).

2. Fruit from Pituri Creek, see p. 14. (A. Henry, 1889). From the Melbourne Herbarium. Not far removed from the type. Note the pedicels in both cases.

3. Fruit, Linda Creek (see p. 14). From Melbourne Herbarium. Note the articulation of the peduncle to the single pedicel.

Var. *sessilis* var. nov.

4*a*. Sessile head of buds; 4*b*, underside view of the same, showing an annulus or disc; 4*c*, side-view of disc. The disc represents morphologically a fusion of pedicels, seated on a scarcely perceptible peduncle; 4*d*, views of anther. Glen of Palms, Macdonnell Ranges, "W.A. Expedition, 1872" (E. Giles).

These are the same buds as those figured in the *E. pachyphylla* plate in the "Eucalyptographia."

5*a*. Ripe fruits (showing annulus); 5*b*, immature fruit. Dalhousie Springs (Finke River, 1880). (Rev. H. Kempe). From Melbourne Herbarium.

6. Leaf and fruits. North of Macdonnell Ranges (Plenty River district). (Lieut. Dittrich.) From Melbourne Herbarium. See p. 16.

7. Fruits. Finke River. (Rev. W. Schwarz, 1886.) From Melbourne Herbarium. See p. 15.

E. pyriformis Turcz., var. *Kingsmilli* Maiden.

8*a*. Mature leaf; 8*b*, the broadest leaf I have seen, but not in the juvenile stage; 8*c*, flowers, showing the slender peduncles and pedicels; 8*d*, anthers; 8*e*, side-view of operculum. Note the dark spot which represents the aperture into the apex of the operculum into which the style and stigma are inserted as into a sheath or case; 8*f*, flower-bud, showing the shortest operculum and pedicel seen; 8*g*, immature fruit; 8*h*, perfectly ripe fruit. All from New England to Mt. Keith (about 160 miles north of Leonora, W.A. (Hon. W. Kingsmill, M.L.C.) The type.

E. Oldfieldii F.v.M.

9. Anthers. Mingenew, W.A. (J.H.M.)

For the remainder of the drawings of *E. Oldfieldii*, see Plate 73, Part XVII. fig. 11, and Plate 74, figs. 1 and 2.

E. Drummondii Benth.

10. Juvenile leaf. Near York, W.A. (O. H. Sargent.)

11. Front and back view of anther. Cut Hill, York. (O. H. Sargent.)

12. Front and back view of anther. Cut Hill, York. (O. H. Sargent.)

Note some variation in Nos. 11 and 12.

For the remainder of the drawings of *E. Drummondii*, see Plate 74, Part XVII, figs. 3, 5, 6, 7, 9, 10.

The following species of Eucalyptus are illustrated in my "Forest Flora of New South Wales"* with larger twigs than is possible in the present work; photographs of the trees are also introduced wherever possible. Details in regard to their economic value, &c., are given at length in that work, which is a popular one. The number of the Part of the Forest Flora is given in brackets :—

acacioides A. Cunn. (xlviii).
acmenioides Schauer (xxxii).
affinis Deane and Maiden (lvi).
amygdalina Labill. (xvi).
Andrewsi Maiden (xxi).
Baileyana F.v.M. (xxxv).
Baueriana Schauer (lvii).
Baueriana Schauer var. *conica* Maiden (lviii).
Behriana F.v.M. (xlvi).
bicolor A. Cunn. (xliv).
Boormani Deane and Maiden (xlv).
Bosistoana F.v.M. (xliii).
Caleyi Maiden (lv).
capitellata Sm. (xxviii).
Consideniana Maiden (xxxvi).
coriacea A. Cunn. (xv).
corymbosa Sm. (xii).
crebra F.v.M. (liii).
dives Schauer (xix).
fruticetorum F.v.M. (xlii).
gigantea Hook. f. (li).
goniocalyx F.v.M. (v).
hæmastoma Sm. (xxxvii).
hemiphloia F.v.M. (vi).
longifolia Link and Otto (ii).
Luehmanniana F.v.M. (xxvi). (=*E. virgata*).
macrorrhyncha F.v.M. (xxvii).
maculata Hook. (vii).
melanophloia F.v.M. (liv).
melliodora A. Cunn. (ix).
microcorys F.v.M. (xxxviii).
microtheca F.v.M. (lii).
numerosa Maiden (xvii).
obliqua L'Hérit. (xxii).
ochrophloia F.v.M. (l).
odorata Behr and Schlechtendal (xli).
oleosa F.v.M. (lx).
paniculata Sm. (viii).
pilularis Sm. (xxxi).
piperita Sm. (xxxiii).
Planchoniana F.v.M. (xxiv).
polyanthemos Schauer (lix).
populifolia Hook. (xlvii).
propinqua Deane and Maiden (lxi).
punctata DC. (x).
regnans F.v.M. (xviii).
resinifera Sm. (iii).
rostrata Schlecht. (lxii).
rubida Deane and Maiden (lxiii).
saligna Sm. (iv).
siderophloia Benth. (xxxix).
sideroxylon A. Cunn. (xiii).
Sieberiana F.v.M. (xxxiv).
stellulata Sieb. (xiv).
tereticornis Sm. (xi).
virgata Sieb. (xxv).
vitrea R. T. Baker (xxiii).

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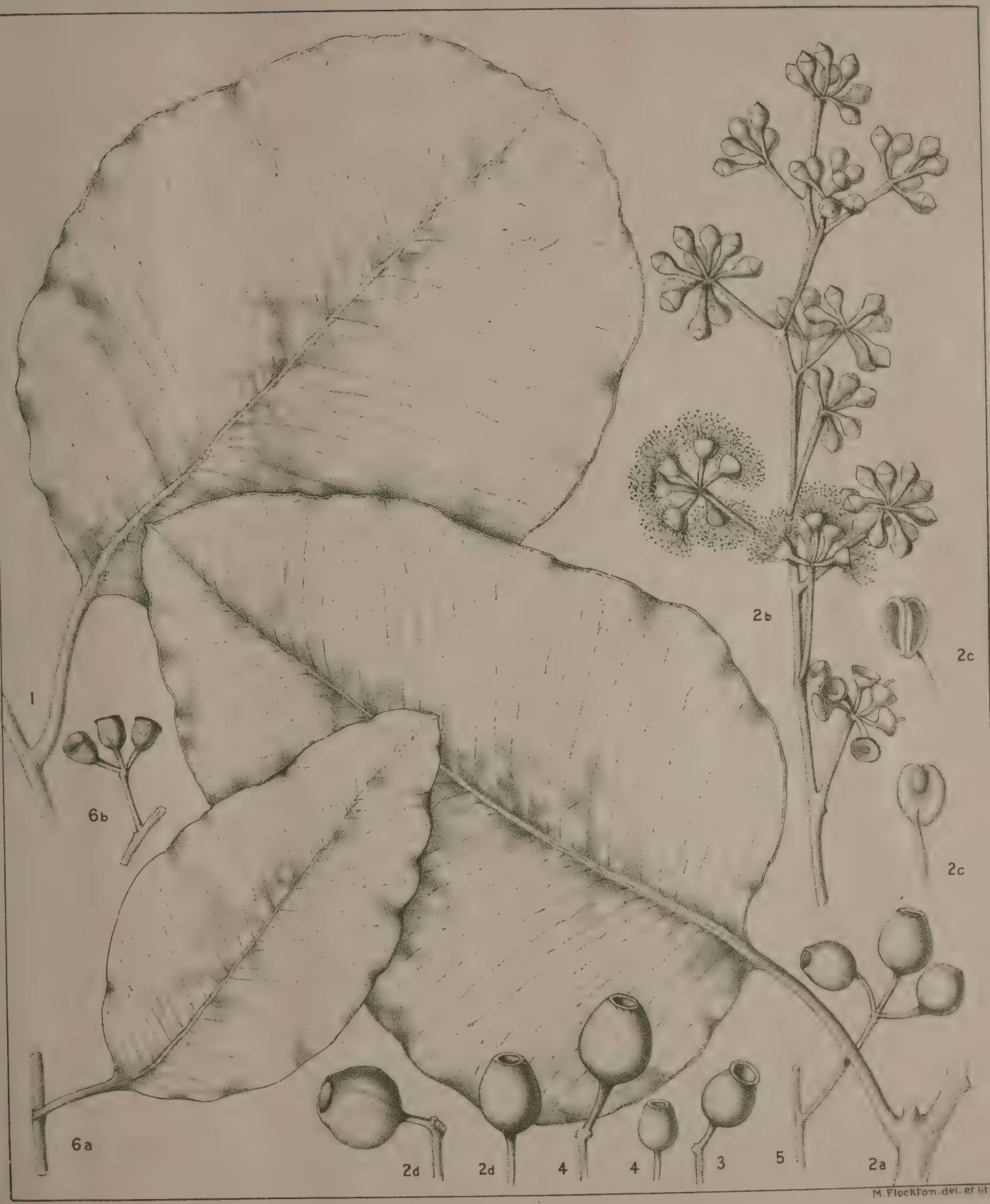
* Government Printer, Sydney. 4to. Price 1s. per part (10s. per 12 parts); each part containing 4 plates and other illustrations.

Sydney: William Applegate Gullick, Government Printer.—1920.



EUCALYPTUS LATIFOLIA F.v.M.

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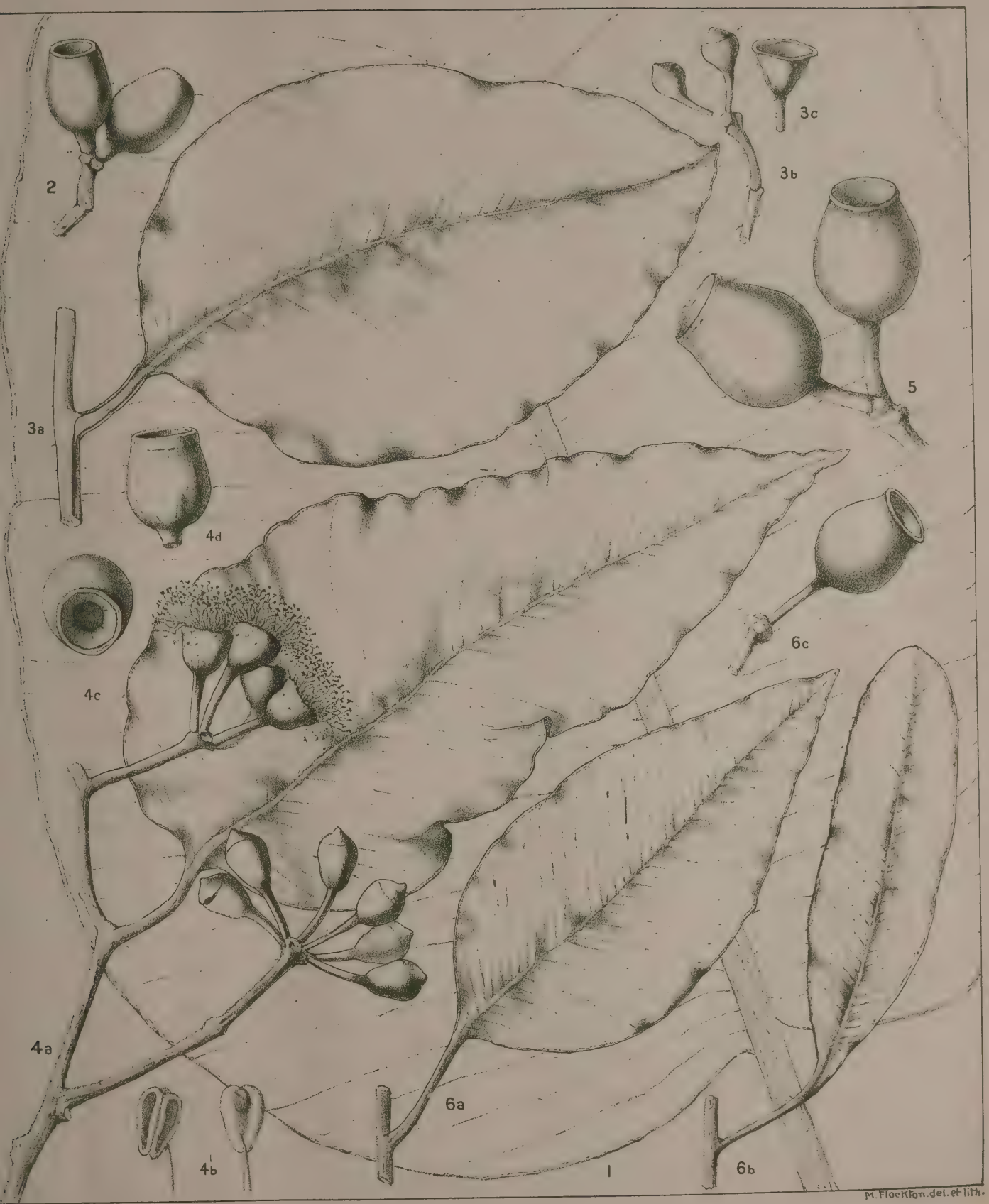

EUCALYPTUS FOELSCHEANA F.v.M. [See also Plate 170.]

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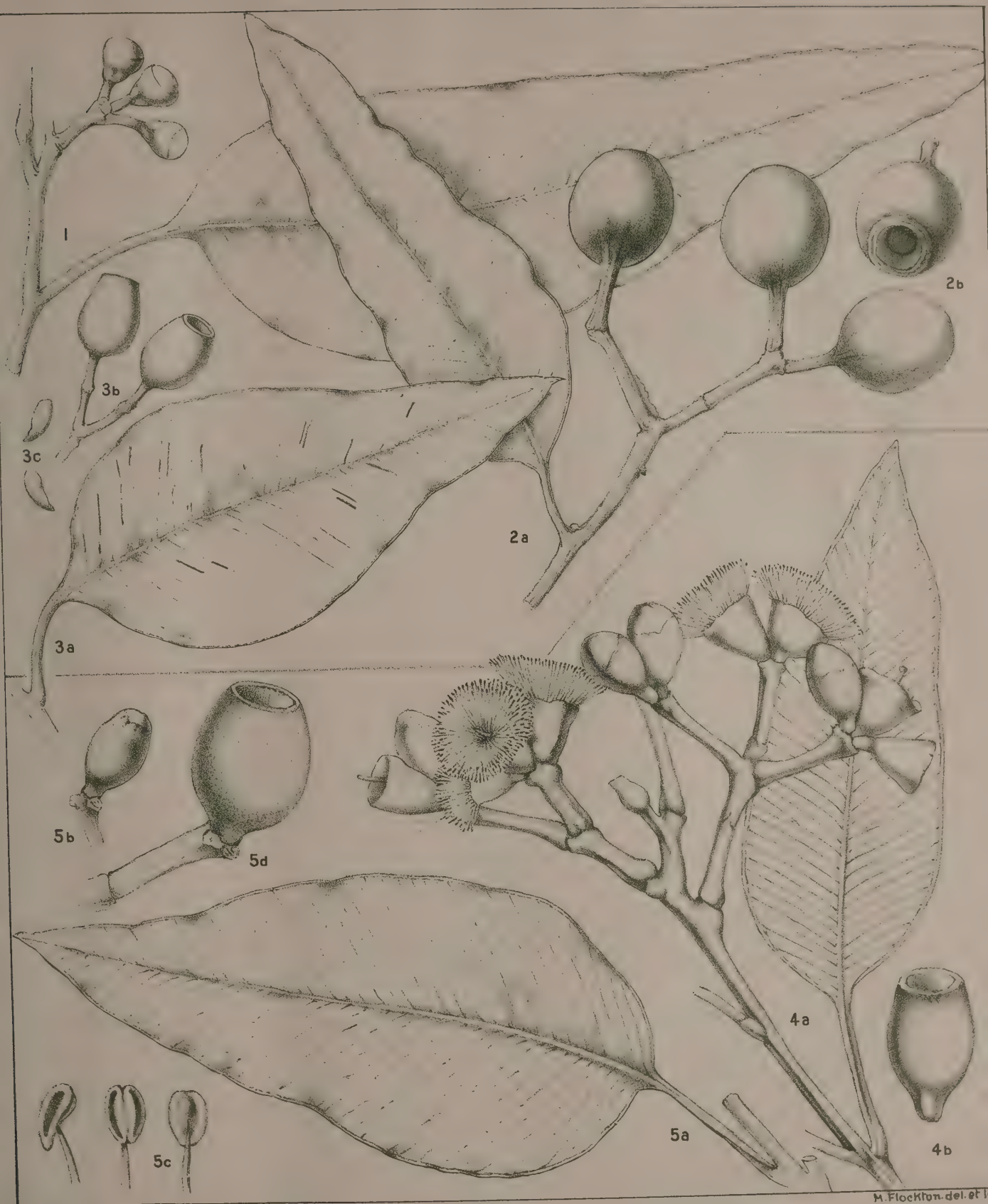

EUCALYPTUS FOELSCHEANA F.v.M. (*1–3*) [See also Plate 169.]

(*The lanceolar-leaved form.*)

E. ABERGIANA F.v.M. (*4, 5*)

EUCALYPTUS PACHYPHYLLA F.v.M. (*1-3*) *var. sessilis.* (*4-7*).
E. PYRIFORMIS TURCZ *var. Kingsmilli* MAIDEN. (*8*).
E. OLDFIELDII F.v.M. (*9*). [See also Plate 73, fig. 11, and Plate 74, figs. 1 and 2.]
F. DRUMMONDII BENTH. (*10-12*). [See also Plate 74, figs. 3, 5, 6, 7, 9, 10.]

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A Critical Revision of the genus Eucalyptus

BY

J. H. MAIDEN, I.S.O., F.R.S., F.L.S.

(Government Botanist of New South Wales and Director of the Botanic Gardens, Sydney).

Vol. V. Part 2.

Part XLII of the Complete Work.

(WITH FOUR PLATES.)

"Ages are spent in collecting materials, ages more in separating and combining them. Even when a system has been formed, there is still something to add, to alter, or to reject. Every generation enjoys the use of a vast hoard bequeathed to it by antiquity, and transmits that hoard, augmented by fresh acquisitions, to future ages. In these pursuits, therefore, the first speculators lie under great disadvantages, and even when they fail, are entitled to praise."

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DESCRIPTION.

CCXXVIII. E. eximia Schauer.

In *Walpers' Repertorium* ii, 925 (1843).

FOLLOWING is a translation of the original :—

Rigid, with firm lanceolate leaves narrowed into a petiole, long, acute, smooth on both sides and sub-opaque, covered with small black dots, imperforate, without veins; the terminal panicle composed of very many—about six-flowered heads with long peduncles; peduncles compressed, somewhat two-edged; operculum coriaceous, convex, umbonate, after expansion sometimes with the hinge of the operculum as if adherent to the obconical wrinkled-angular calyx-tube (and the remaining parts ?) glaucous-hoary, finally smooth shining. Leaves half a foot long and longer, about an inch broad. Flowers showy, 6 lines long; stamens elongated, white. Collected in New Holland in former days by Ferd. Bauer.

It was described by Bentham in B.Fl. iii, 258, as follows :—

Leaves falcate-lanceolate, acuminate, mostly 4 to 6 inches long, with numerous veins, fine and parallel, but scarcely visible owing to the thick coriaceous texture. *Flowers* several together, closely sessile in heads, which are usually arranged on thick angular or flattened peduncles, in terminal corymbs or panicles. Calyx-tube thick, obconical, somewhat angular, much tapering at the base, 3 to 4 lines long. *Operculum* broadly conical or shortly acuminate, always much shorter than the calyx-tube, and double, as in *E. maculata*, but the inner one not readily separable in the dried specimens till the flower is ready to open. Stamens 3 to 4 lines long; *anthers* ovate-oblong, the cells parallel, opening longitudinally. *Ovary* short, flat-topped. *Fruit* urceolate, ¾ to 1 inch long, the rim thin, the capsule deeply sunk.

It is described and figured by Mueller in the " Eucalyptographia."

Caley, at the beginning of the 19th century, called it " Snuff-coloured Bark Eucalyptus," which is descriptive, but, it seems to me, it gives an idea that the bark is browner than it really is. The colour of the bark is a dirty yellow.

By Sydney people this is variously known as " Mountain Bloodwood," " Yellow Bloodwood," and " Rusty Gum." It is called " Bloodwood " partly because kino exudes in the concentric circles of the wood (which kino, by the way, cannot be mistaken for that of *E. corymbosa*). Baron von Mueller states (" Eucalyptographia "), following Dr. Woolls, I find, that it sometimes goes by the name of " Smooth-barked Bloodwood," but I have not heard it so called.

The purple (plum violet) of the young foliage is a very conspicuous object, and it has long been known that it contains a small percentage of caoutchouc, as does that of the common Sydney Bloodwood (*E. corymbosa*).

Mr. W. F. Blakely noted that the young shoots in the Hornsby-Galston district (near Hawkesbury River) distinctly smell of oil of lemon (February, 1918).

Bentham (B.Fl. iii, 258), speaking of the operculum, says " . . . double, as in *E. maculata*, but the inner one not readily separable in the dried specimens til the flower is ready to open." Mueller follows the matter up in the " Eucalyptographia," but I think it will be best to deal with the morphology of the opercula (which involves consideration of a number of species), when dealing with the morphology of the genus in the second portion of this work.

DOUBTFUL SYNONYM.

E. elongata Link, *Enum. Hort. Berol.* ii, 30 (1822).

Following is a copy of the original :—

" 223. *E. elongata.* Fol. lanceolatis attenuatis acumine subfiliformi reticulatim venosis. Hab. in Australia. T. Fol. pet. 8″ longo lamina 4–5′ lga. 10″–1′ lata coriacea. Non floruit." A specimen in the Vienna Herbarium labelled " Eucalyptus elongata Link, Ferd. Bauer, Herb. Bauer " is *E. eximia* Schauer.

On the other hand, we have the species rather more fully described in DC. Prod. iii, 222, as follows :—

" 49. *E. elongata* (Link l.c.) foliis alternis lanceolatis attenuatis acumine subfiliformi reticulatim venosis coriaceis. In Nov. Hollandia. Folii petiolus 8 lin. longus, lamina 4–5 poll. longa 10–12 lin. lata. An forte eadem ac *E. cornuta* aut potius *E. persicifolia*? (v.s. sine fl. ex hort. Berol).

A single leaf, from the Prodromus Herbarium (from M. Casimir De Candolle) has the following label :—

(Manu Ottonis), " Eucalyptus elongata Lk. En."

(Manu Seringei), " Jardin de Berlin Mr. Otto, 1826."

(Manu DC. ii), " An cornuta? persicifolia? "

It is not *E. eximia*. I would not like to state its origin at present. *E. elongata* Link, in Otto's handwriting, was written by the collaborator of Link in much botanical work.

RANGE.

The collection of the type is credited to Ferdinand Bauer, as is the case with other specimens collected by Robert Brown, but forming part of a collection of Bauer's (who was Sir Joseph Banks's artist attached to Brown), which found its way to the Vienna Herbarium. Brown described it and gave it a name, but, like so many of Brown's descriptions of Eucalyptus, it never saw the light. The type came from the Grose River, New South Wales.

Bentham gives "Banks of the River Grose, *R. Brown*, and (lower) Blue Mountains, *Miss Atkinson*." Mueller ("Eucalyptographia") adds Bent's Basin (Woolls), which is on the Nepean, about 22 miles south of its junction with the Grose. The Dogwood Creek, Queensland, specimens, collected by Leichhardt and referred to in the "Eucalyptographia," under *E. eximia*, are *E. peltata* F.v.M.

It seems to be confined to the sandstone of eastern-central New South Wales, its most southerly recorded locality being Jervis Bay, and northerly one Howe's Valley, near Singleton, while the most westerly locality is Springwood, in the lower Blue Mountains (1,200 feet).

Southern localities.—A specimen in Herb. Cant., Ex herb. Lindl., labelled, "7 feet high, P. Jarvis, Fraser" (Jervis Bay, Fraser died in December, 1831) is *E. eximia*. Another specimen, labelled "Eucalyptus sp., height 50 feet, flowers in September, Port Jervis" (Jervis Bay) (Fraser), in Herb. Oxon. is this species.

The next most southerly locality recorded is Shoalhaven River (Badgery's Crossing to Nowra, W. Forsyth and A. A. Hamilton). It is remarkable that it has never been recorded from Jervis Bay since Fraser's time, nor between Jervis Bay and the Shoalhaven.

Yalwal, 18 miles from Nowra, Shoalhaven district (R. H. Cambage). Picton Lakes (R. H. Cambage). It is obvious that we want more collecting over southern localities for this species.

A large tree of this species used to be in Government House Grounds, just inside the gates. It was demolished during the widening of Macquarie-street, in 1913. It may have been an original specimen of the Sydney flora, still preserved to some extent in the Outer Domain, but I doubt it.

Western localities.—Very common about Glenbrook and Blaxland, but was not observed beyond Springwood. October is the usual flowering time for this species, but the evidence available on 12th November last went to show that, with but few exceptions, it did not flower last spring; and it is worthy of note that it flowered profusely in 1900 and 1902, but was almost destitute of flowers in 1901 (*vide* these Proceedings, 1902, p. 206). Many of the trees were rendered attractive in November by the display of purple foliage on the young shoots. (R. H. Cambage and J.H.M., *Proc. Linn. Soc. N.S.W.* xxx, 199, 1905).

Mulgoa (R. H. Cambage, J.H.M.). "This is the 'Mountain Bloodwood.' The bark is generally different in texture from the other. It is not so thick, and looks more like the bark of a Mahogany or Woolly Butt." Near Bent's Basin (Rev. Dr. Woolls).

"Smooth-barked Bloodwood," specimen from cliffs near Bent's Basin (W. Woolls). Bent's Basin, only on the sandstone ridge (J.H.M.). Bent's Basin is on the Nepean River, a few miles south of Penrith.

Following are two historical specimens. They are co-types. "Banks of the Grose." Robert Brown, 1802–5. (Presented by J. J. Bennett at the 1876 distribution from the British Museum, No. 4776.)

"Snuff-coloured bark Eucalyptus, Grose, September, 1804, F2." (George Caley.) (Presented by British Museum through Dr. A. B. Rendle, No. 42.) (Grose Head on other specimens.)

Grose's Head was a name originally given by Caley himself. There is a reference to its use by Bligh on 31st October, 1807 (*Hist. Rec. Aust.* vi, 145), who speaks of it as "A high, commanding situation called Grose's Head." The name is several times used by Blaxland in his "Journal of a Tour of Discovery Across the Blue Mountains in the year 1813." One of the references is that at Glenbrook Lagoon, "the high land of Grose Head appeared before them at about 7 miles distance, bearing north by east." Mr. Alexander Wilson told me that Grose Head is a bluff at the junction of Burralow Creek and Grose River (a few miles from the junction of the latter with the Nepean), parish of Burralow, county of Cook.

Mr. R. H. Cambage and I, in 1906, saw it when we ascended the Grose River from the Nepean. We could only progress about 5 miles from the Nepean junction to the head of navigation. We then came to large sandstone boulders, but could hardly progress a short distance over them, and continued progress was impossible. Looking up the stream, the fine bluff of Grose Head was the prominent feature of the landscape. It is easy to suppose that Caley saw it from this position.

Northern localities.—Between 17–19 mile-posts, Galston road, Hornsby (W. F. Blakely). At the Linnean Society's excursion of the 27th April, 1889, numerous individuals, including some very fine trees, of this species were found at the junction of the Berowra Creek with the Hawkesbury River. This was the most northerly locality known for a number of years. (Henry Deane and J.H.M.)

I am indebted to Mr. W. F. Blakely for the following notes on the occurrence of this species between Hornsby and Hawkesbury River, including its association with *E. squamosa* Deane and Maiden :—

There are several fine belts of this species on the eastern and north-eastern spurs of the rugged sandstone country along Berowra Creek, from the Galston Valley, on the Galston road between the 17–19 mile-posts, to Brooklyn on the Hawkesbury River; and also in similar situations in various places throughout the Kuring-gai Chase; namely, on the Gibberygong track, Kuring-gai Chase boundary line, 2 miles east of Hornsby; Bobbin Head (plentiful); along the Chase road to Mt. Colah (two patches); close to railway line at Kuring-gai, Berowra, Cowan and Hawkesbury River stations. It is also common at various points along Cowan Creek. For instance, fine specimens are to be seen at Windybanks and at Jerusalem Bay.

On the Pittwater side of the Chase there is a patch of it towards the head of Cowan Creek.

It is interesting to note that besides occupying the highest points in the strip of country between Manly and Brooklyn, *E. eximia* descends to the sea-level, attaining its greatest development on the lower levels, but some really good specimens are met with at considerably high elevations.

Association with E. corymbosa Sm. and E. squamosa Deane and Maiden.

E. eximia is often associated with *E. corymbosa* and *E. squamosa*, but to a limited extent. It usually prefers the well-drained rugged, often precipitous ridges, with a northerly or easterly aspect, as seen along the railway line near the Hawkesbury River station, while *E. corymbosa* prefers the better-class soils of the northern, eastern, and western slopes; also the medium soils interspersed with ironstone gravel of the flat, open forests, on the tops of ridges. On the other hand, *E. squamosa* is usually confined to the moist tops and somewhat sour, swampy, elevated southern depressions. When these species meet, they do not penetrate beyond their ecological boundaries. In any case, *E. corymbosa* is the most aggressive of the three, for it appears to have adapted itself to all sorts of environmental conditions.

We now cross to the northern bank of the Hawkesbury River.

Woy Woy and Hawkesbury River (Andrew Murphy).

"Pepper," not Peppermint, is the Colo name, Hawkesbury River (a surveyor whose name I have forgotten).

Maitland (Sawyer's Gully), where it is known as Rock Apple. (R. H. Cambage.)

AFFINITIES.

We are dealing in this Part with four Yellow-barks or Yellow-jackets. They all have palish timber (in contradistinction to reddish), viz., *E. eximia*, *E. peltata*, *E. Watsoniana*, and *E. trachyphloia*, and have some affinities for that reason. They are contrasted at p. 47.

E. eximia is a member of the Corymbosæ, and Bentham (B.Fl. iii, 199) places it nearest to *E. maculata*, giving the key.

Flowers pedicellate in 3-flowered umbels ... *E. maculata.*

Flowers sessile, in heads ... ... *E. eximia.*

These are the only two species of the section he records as having a double operculum.

Mueller's views as to the affinities of *E. eximia* will be given in his own order.

1. With *E. Watsoniana* F.v.M.

E. eximia is closely related to *E. Watsoniana*, differing mainly in narrower leaves, in the smaller flowers without any stalklets, in the lid not exceeding the width of the calyx-tube, and in smaller fruits with not emerging or protruding disc. ("Eucalyptographia," under *E. eximia.*)

This is the only other Yellow-jacket with which Mueller contrasts it, and I will refer to the affinity under table at p. 47.

2. With *E. Abergiana* F.v.M.

In its panicles it resembles *E. Abergiana*, but the leaves are almost sickle-shaped and not conspicuously darker above, the lid and calyx-tube are separated by a clear sutural line, and the seeds are not provided with a terminating membrane. ("Eucalyptographia," under *E. eximia.*)

For *E. Abergiana*, see Plate 170, Part XLI. The two species are sharply separated by the non-yellow bark, and the red timber of *E. Abergiana*. The mature foliage of that species is broader, the buds ovoid, and therefore the opercula non-conoid, the peduncles thicker and more distinctly articulate, the fruits larger and more woody. At the same time, we are not fully aware of the amount of variation in that species.

3. With ***E. maculata*** Hook. f.

E. eximia claims particularly close relationship to *E. maculata*; but its distinctness is vindicated by the persistency and peculiarity of the bark, by the still finer venation of the leaves, by the flowers being of larger size and devoid of stalklets, by the less ready separation of the outer and inner lid from each other, by the petaloid whitish not shining inner but smoother and more lustrous lid, and by the larger fruits; the seedling state may also be different. ("Eucalyptographia," under *E. eximia*.)

Mr. W. F. Blakely informed me, in February, 1918, that young shoots of *E. eximia* in the Hornsby, Sydney, district, distinctly smelled of oil of lemon. This indicates affinity to *E. maculata* var. *citriodora*. I will postpone further consideration of the contrasts until *E. maculata* is reached in Part XLIII.

4. With ***E. corymbosa*** Sm.

Although called a Bloodwood tree, it differs widely from *E. corymbosa*, not only in some of the characteristics of its flowers and fruits, but also in foliage and bark, the latter being of more scaly texture and also smoother outside. ("Eucalyptographia," under *E. eximia*.)

For *E. corymbosa* see Part XXXIX, Plates 161, 162. The latter has a hard, scaly, non-yellow bark, with red timber. Its flush of young foliage is reddish rather than purple, and its very young leaves are non-petiolate. The two species differ in the shape of the fruits, which have pedicels in *E. corymbosa*, which also has its buds more clavate.

DESCRIPTION.

CCXXIX. E. peltata Bentham.

In B.Fl. iii, 254 (1866).

Following is the original description :—

A tree with a dark, shining, brittle, flaky, but persistent bark (F. Mueller).

Leaves from nearly orbicular to oblong-ovate, obtuse, rather large, peltately inserted on the petiole above their base, rusty-scabrous or glabrous or somewhat glaucous, with diverging but not close veins.

Flowers rather large, nearly sessile in the umbels, which are arranged in oblong (or corymbose) terminal panicles, but not seen expanded.

Calyx-tube obconical in the bud, about 3 lines long, smooth and shining.

Operculum much shorter, obtusely conical or hemispherical.

Anthers ovate-oblong, with parallel cells.

Fruit urceolate-globose, about 4 lines diameter, contracted above the deeply-sunk capsule, the rim thin, seeds (which I have not seen) smooth and not winged according to F. Mueller.

It was figured and further described by Mueller in the " Eucalyptographia."

A small or middle sized tree, with a straight trunk seldom above 15 feet long or more than 18 inches in diameter, with a spreading rather dense top (Johnson); foliage drooping, the greatest height of the whole tree about 30 feet (Tenison-Woods). Bark everywhere (all over the tree) persistent, lamellar, very brittle, somewhat shining and brownish or pale-yellowish, the colour of the bark having originated the curious vernacular of Yellow-jacket for this tree. (" Eucalyptographia.")

In 1908, when I received a full suite of specimens from the Emerald District, misled by Bentham's description of the peltate juvenile leaves as mature ones, I thought it might be new, and carefully described it, but did not publish it.

Following is the description of the juvenile leaves, made at the time :—

Broadly lanceolate to orbicular, peltate (up to 10–15 cm. long and 3·5–4 cm. broad being common dimensions), symmetrical, the slightly flattened glaucous branchlets and the midribs sparsely besprinkled with weak brown hairs, the tips of the branchlets densely hairy. Equally green on both sides, or but slightly paler on the under side, thin, petiolate, midrib distinct and slightly channelled, lateral veins irregularly curved, rather distant from each other, passing through a more parallel stage until they become feather-veined in the adult stage; the intramarginal vein at a considerable distance from the edge. Mature leaves of the ordinary lanceolate shape.

I have since found that the peltate condition of leaves in Eucalyptus is more common than was at one time supposed, but a full discussion of this character may well be deferred until the Morphology portion of this work is reached.

Following is an excellent account of the tree :—

Eucalyptus peltata is known around Alma-den as Yellow Jack, from the yellowish colour of the scaly bark, which is of much the same texture as that of the Bloodwood group, though perhaps a little more flaky. This rough scaly bark extends to the branchlets, the tips of which are angular, glabrous and yellowish. The timber is pale towards the outside of the tree, but dark brown near the centre. The fruits are slightly urceolate and the sessile buds are angular in dried specimens. The only peltate leaves seen were amongst the ovate, scabrous, " sucker " foliage. The adult leaves examined are glabrous and lanceolate, with a yellowish midrib, and are 5 to 6 inches long and one-quarter of an inch to 1 inch broad. The " sucker " stems are hispid. (R. H. Cambage in *Proc. Roy. Soc. N.S.W.*, xlix, 407, 1915.)

SYNONYMS.

1. ***E. melissiodora*** F.v.M. in *Journ. Linn. Soc.* iii, 95 (1859), but not of Lindley.
2. ***E. Leichhardtii*** Bailey.
3. ***E. eximia*** Schauer, var. ***Leichhardtii*** Ewart.

1. ***E. melissiodora*** F.v.M. in *Journ. Linn. Soc.* iii, 95 (1859).

Following is a translation of the original :—

A tree, branchlets compressed-tetragonal, rough, leaves opposite or sub-opposite, ovate or sub-cordate, rarely oblong-lanceolate, petiolate and scabrous above the rounded somewhat inflexed base, opaque, covered with translucent dots, penniveined reticulately veined, peripheral vein unequally distant from the margin, umbels paniculate, 6–7 flowered, peduncles scabrous, angled and longer than the calyx-tube, buds ovate, smooth, ecostate shortly pedicellate, the calyx-tube half as long again as the interior conical-hemispherical operculum, the outer operculum imperfect, fruits campanulate, three-celled, smooth at the vertex, valves included, seeds smooth, winged. Habitat in the porphyritic mountains of Newcastle Range. Flowered October and November. A small or medium sized tree, trunk straight, bark adhering all over, shining with brittle dirty yellow flakes. Branchlets and peduncles grown over with an ash-coloured and rusty roughness. Leaves with a petiole ½–1 inch long, semiterete, for the most part, adhering above the base, rarely to the margin, generally 2–3 inches long, 1½–2½ inches broad, in the abnormal specimen collected by Mitchell* up to 5 inches long and 1 inch only broad, sometimes acute, sometimes obtuse or rather emarginate. Calyx-tube shining obconical, semi-ovate, 2–3 lines long narrowed into a very short pedicel. Operculum double, the exterior one chestnut brown, slowly coming away in pieces, grown to the interior one; the interior one 1½ lines long. Fruit about 4 lines long, perfectly campanulate, green, somewhat smooth at the vertex, valves inserted above the middle of the tube. Seeds brown, shining. The species is remarkable for the double operculum.

Mueller (" Eucalyptographia " under *E. peltata*) concurs in Bentham's opinion that *E. melissiodora*, " might merely constitute the young state of *E. citriodora*, and this has been confirmed through local observation by Dr. E. Wuth, whose attention I directed to this subject." He goes on to point out that, in dealing with *E. maculata* in " Eucalyptographia," he added *E. peltata* as a synonym by a slip of the pen.

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* This is another plant, the true *E. melissiodora* Lindl., which is a synonym of *E. maculata* var. *citriodora*.

2. *E. Leichhardtii* Bailey, in *Queensland Agric. Journ.* xvi, 493 (May, 1906).

The original description is as follows :—

"Yellow Jack" or "Yellow Jacket." A tree of small size, the timber not considered durable. Bark on the trunk thick, spongy, and somewhat lamellar; colour a light yellowish-brown; deciduous on the smaller branches. Leaves 3 to 6 inches long, falcate-lanceolate, the apex often elongated and filiform, the base somewhat oblique, tapering to a petiole of about 1 inch ; transverse parallel veins very numerous, but not very distinct owing to the coriaceous texture of the leaf, the intramarginal one rather distant from the edge. Flowers several together, nearly or quite sessile, in heads which are arranged on thickish (more or less angular) branches of a terminal panicle from 4 to 8 inches long. Calyx-tube thick, angular-rugose, much tapering towards the base in the flower, about 4 lines long and 3 lines broad at the top. Operculum broadly conical or shortly acuminate, considerably shorter than the calyx-tube, usually in the fresh state of a glossy-purple, texture thin and tough; from the centre a descending tube is formed by the petaloid portion or inner membrane which encloses the summit of the style and stigma before the flower expands, similar to what Mueller points out as occurring in *E. eximia*. Stamens 3 to 4 lines long; anthers oblong; cells parallel, opening longitudinally. Ovary flat-topped. Fruit urceolate, about 6 lines long, rim rather thin; capsule deeply sunk, 3-celled. Seeds oblong, about 3 lines long, 1½ lines broad, smooth, flat and glossy-brown.

Hab. :—Near Alice, Central Railway (received from Mr. Wm. Pagan, Chief Engineer for Railways).

The above species seems only to have once previously been brought under notice, and then by Baron Mueller when describing *E. eximia*, in his grand work, "The Eucalyptographia," where he says : "Imperfect specimens, collected by Dr. Leichhardt on Dogwood Creek, in Queensland, and designated 'Rusty Gum-tree,' seem referable to *E. eximia*."

3. In a paper in *Vict. Nat.*, p. 56 (July, 1907), Prof. Ewart deals with *E. Leichhardtii*, which he reduces to *E. eximia* Schauer, var. *Leichhardtii* Bailey [this should be var. *Leichhardtii* Ewart, according to a letter from Prof. Ewart.—J.H.M.], and incidentally refers to the fact that Mueller has referred similar specimens, presumably including "imperfect specimens, collected by Dr. Leichhardt on Dogwood Creek in Queensland, and designated 'Rusty Gum-tree,' seem referable to *E. eximia*." ("Eucalyptographia," under *E. eximia*.)

"A point apparently overlooked by Bailey is that the internal ledge just within the rim is nearly horizontal, instead of sloping inwards and downwards as in *E. eximia* type, so that the outer chamber of the fruit is saucer-shaped instead of cup-shaped. In this respect, as well as in the size of the fruit, the capsules show an approach to *E. maculata*, but in the bark, and in other features, the two trees differ considerably." (Ewart, *loc. cit.*)

RANGE.

The type came from Newcastle Range, Queensland, which is east of the Etheridge and the Gilbert, in Northern Queensland, and of the township of Georgetown. It was collected by Mueller during Gregory's Northern Territory Expedition of 1856.

In the "Eucalyptographia," Mueller extends the localities as follows: "On porphyritic mountains at the sources of the Burdekin, Lynd, and Gilbert Rivers (*Mueller*); on granite hills near Charters Towers, on auriferous formation (*Tenison-Woods*); at Ravenswood, near the Burdekin River (*S. Johnson*)."

These are the most northerly localities (see also some mentioned by Leichhardt for "Rusty Gum" below). Then we have a group of localities around Emerald, Central Railway, while the most southerly locality is that of Leichhardt, on Dogwood Creek, near Dulacca Railway Station. Leichhardt's specimens are fragmentary, but I have no doubt as to their identity.

It will thus be seen that *E. peltata* has a very extensive range in Queensland, occurring in rather dry situations, and on somewhat sterile soil.

I have a specimen from the Melbourne Herbarium, "*E. peltata* Benth., *E. mellissi-odora* Lindl. Newcastle Range (Mueller)." This is Mueller's label. It has a nearly orbicular leaf, a sucker leaf, as figured in "Eucalyptographia."

Cape River (Stephen Johnson) in Herb. Melb. Mueller also quotes Charters Towers and Ravenswood, which are in about the same latitude. (Ravenswood is by Rev. J. E. Tenison-Woods.)

"Yellow Jack." "Rough, scaly yellow bark to branches, wood pale, light brown centre. 30–40 feet high. On granite at 1,600 feet." Alma-den (R. H. Cambage, Nos. 3884, 3885).

"This species occurs plentifully between Einasleigh and Wirra Wirra, near Forsayth. Exactly similar trees, as regards appearance and habit, were seen from the train in the Desert near Jericho, to the east of Barcaldine, but as these trees were not examined, their identification is doubtful, though it is understood they are known as *Eucalyptus Leichhardtii* Bailey." (R. H. Cambage in *Proc. Roy. Soc. N.S.W.*, xlix, 407, 1915.)

All the above localities are in the same general area, viz., the southern part of Cape York Peninsula, and east of the southern part of the Gulf of Carpentaria. This general area includes the localities for the species as quoted by Mueller in the "Eucalyptographia."

Going south, we have a Bloodwood, Washpool Creek, Eidsvold (sent by Dr. T. L. Bancroft as *E. eximia*).

Coming further south, we have "Yellow Jack," Chinchilla State Forest. (Forest Ranger George Singleton, C. T. White's No. 12.) This is on the South-Western line. Note also Leichhardt's locality of Dogwood Creek, near the modern Dulacca. See below, p. 37.

Further north still, we have a group of localities on the Central Railway.

"Yellow Jacket," Desert Country, west of Emerald (R. Simmonds). From the same locality Mr. J. L. Boorman reports, "Tree of medium size (trunks 18 inches to 2 feet in diameter being common), bark of a Bloodwood character, and of a light or yellow colour."

" Yellow Jacket. Medium-sized trees of 30–40 feet. Stems of 1–4 feet in diameter, but never more than 15 feet or so of milling timber, it being generally difficult to obtain more than posts and rails, its principal use. Wood dark brown in centre, pale yellow sapwood. Flaky bark, from base of stem up to branches, having a yellowish appearance." Beta (J. L. Boorman).

Still a little further, on the same line, viz., at 328 miles from Rockhampton, we have a specimen of the type of *E. Leichhardtii*, which came from Alice, Central Railway (W. Pagan, through F. M. Bailey).

In considering the range of the species, it is necessary to study the notes on Leichhardt's Rusty Gum, which follow.

The Rusty Gum of Leichhardt :—

Not a mile further on [from his Acacia Creek] we came on a second creek, with running water, which from the number of Dogwood shrubs (*Jacksonia*), in the full glory of their golden blossoms, I called Dogwood Creek. The creek came from north and north-east, and flowed to the south-west to join the Condamine. The rock of Dogwood Creek is a fine-grained porous Psammite (clayey sandstone) with veins and nodules of iron, like that of Hodgson's Creek. A new gum-tree, with a rusty-coloured scaly bark, the texture of which, as well as the seed-vessel and the leaf, resembled Bloodwood, but specifically different . . . (Leichhardt's " Overland Expedition to Port Essington," p. 20.)

These are the specimens of Leichhardt referred to by Mueller in the " Eucalyptographia," under *E. eximia*, as probably referable to that species, but they belong to *E. peltata*. Dogwood Creek is a little to the south of Dulacca Railway Station on the Western Railway.

If we peruse Leichhardt's work we find other references to Rusty Gum. Perhaps the following are the whole of them.

At the junction of the Suttor and Cape Rivers, he says, " The country back from the river is formed by flats alternating with undulations, and is lightly timbered with Silver-leaved Ironbark, Rusty Gum, Moreton Bay Ash and Water-box. The trees are generally stunted and unfit for building . . ." (p. 195).

At p. 208, approximate latitude 20° 8′ 26″, which would bring us to, say, the Charters Towers group of localities, " The ridges were covered with Rusty Gum and Narrow-leaved Ironbark."

Then we have, " A new Eucalyptus with a glaucous suborbicular subcordate leaf, and the bark of the Rusty Gum; a stunted or middle-sized tree, which grew in great abundance on the ranges" (p. 230). Mr. Cambage tells me that the locality referred to is on the Burdekin River, below Grey Creek, but above the Perry and Clarke Rivers. Roughly 100 miles north-west of Charters Towers, or 100 miles south-east of Einasleigh, or 50 miles south-west of Stone River. The suborbicular, subcordate leaves may, of course, refer to peltate leaves, which are more abundant on some trees than on others. On the other hand, Leichhardt calls it a " new Eucalyptus," and he therefore probably thought it different from the trees he usually calls Rusty Gum. On the other hand, it may represent trees with an inordinate proportion of juvenile leaves. The species of Leichhardt's, p. 230, is therefore doubtful.

At p. 304, "We travelled . . . over a succession of plains separated by belts of forest, consisting of Bloodwood, Box, Apple Gum, and Rusty Gum." This was near the Lynd River.

At p. 355, "Some of the ridges were openly timbered with a rather stunted White Gum tree, and were well grassed, but the grass was wiry and stiff. At the end of our stage, about 16 miles distant from our last camp, we crossed some Rusty Gum forest . . ."

At p. 356, "In a patch of Rusty Gum forest we found *Acacia equisetifolia* and the dwarf *Grevillea* of the Upper Lynd in blossom. The thyrsi of scarlet flowers of the latter were particularly beautiful." Here they were a little south of the Albert River of Captain Lort Stokes.

AFFINITIES.

1. With *E. latifolia* F.v.M.

Possibly a variety or state of some species allied to *E. latifolia* without the peltate leaves. The specimens are very imperfect. (B.Fl. iii, 254.)

In many of its characteristics, especially the form of its fruits, *E. peltata* approaches to *E. latifolia*, but the latter is smooth-barked, its leaves are partly almost opposite and always attenuated, with an acute base into their stalk, the lateral veins less prominent, the reticulation of the veinlets also less visible, while the marginal vein is almost confluent with the edge of the leaves, the stalklets of the flowers are of conspicuous length, the lid is single and separates by a less regularly marked dehiscence, and the brownish roughness of the branchlets and foliage is absent, in which latter respects an approach of *E. peltata* to *E. ferruginea*, *E. aspera*, *E. setosa*, and *E. clavigera* is established. ("Eucalyptographia" under *E. peltata*.)

The mistake that *E. peltata* has peltate leaves in the full-grown state also misled L. Diels, who, in his "Jugendformen und Blutenreife," says that, except in these (assumed) adult leaves, "otherwise it shows in many characters, especially in the very important shape of the fruit, great approach to *E. latifolia*. It is more than probable that the two species are closely connected; indeed, also in their geographical distribution they belong to the same region, *i.e.*, North-eastern Australia. Unfortunately the ontogeny of *E. latifolia* is not perfectly known. I could nowhere find a description of the juvenile leaves."

For *E. latifolia*, see Plate 168, Part XLI, where it will be seen that the two species are not closely allied. The juvenile leaves of *E. latifolia* are larger, glabrous, and not peltate. The mature leaves are broad. The inflorescence is very different. The flowers are more numerous and, like the fruits, have comparatively long pedicels. The fruits are, for the most part, larger, and have thicker walls; while after the falling of the outer strips of bark the inner bark is yellowish. The bark is not yellowish as a whole, and the timber is red. *E. peltata* is a Queensland species, while *E. latifolia* belongs to the Northern Territory.

2 and 3. With *E. miniata* A. Cunn., and *E. phœnicea* F.v.M.

E. peltata is, however, well marked, as noticed by myself in 1856 on the sources of the south-eastern rivers of Carpentaria, by the remarkable texture and structure of the bark, in which respect it bears resemblance only to *E. phœnicea* and *E. miniata*, constituting with them the section of Lepidophloiæ in the cortical system. ("Eucalyptographia," under *E. peltata*.)

For *E. miniata* and *E. phœnicea* see Plate 96, Part XXII, with the juvenile leaves of the former described at p. 37. The juvenile leaves of *E. miniata* are not petiolate; those of *E. phœnicea* are not known. The buds and fruits are very different from those of *E. peltata*, those of *E. miniata* being very large and ribbed, the ribbing being less marked in *E. phœnicea*. There are other differences that comparison of the figures will readily disclose. The filaments of *E. miniata* and *E. phœnicea* are orange to scarlet, while the barks are more lamellar and friable.

4. With *E. Torelliana* F.v.M.

Perhaps *E. peltata* will require to be placed nearest to *E. Torelliana*, although the latter stands on record as one of the tallest forest trees near Rockingham Bay, with a "bark smooth as glass"; moreover, the hairiness of its branchlets and leaf-stalks is more conspicuous, all its leaves are of completely basal insertion and evidently paler beneath, therefore their stomata are not isogenous, but (as tabulated before) heterogeneous; the flowers and fruits may also prove different, the former being only as yet known in an unexpanded state and the latter having never yet been collected at all.

For *E. Torelliana* see Part XXXIX, Plate 160. It will be at once seen that the two species have much in common—the broad-leaved, hirsute, peltate juvenile leaves, succeeded by narrow-lanceolate leaves, the venation being less fine and feather-like in *E. peltata*. The difference in the aspect of the trees has already been referred to, the size, bark, and timber being all dissimilar. The buds are different, but the markedly urceolate fruits of *E. Torelliana* are more markedly so. The latter species is a coastal species with high rainfall. The other is a comparatively dry-country species.

DESCRIPTION.

CCXXX. E. Watsoniana F.v.M.

In *Fragmenta* x, 98 (1876).

Following is a translation of the original :—

A tree with somewhat terete branchlets, leaves sparse, ovate or narrow-lanceolate, slightly falcate, the same colour on both sides, with rather long petioles, imperforate, veins very divergent, faint and abundant, the two longitudinal veins close to the margin, panicles terminal, few or many flowered, the last peduncles 2–4 flowered, the rather large campanulate-turbinate almost ecostate calyx-tube the same length as the quadrangular pedicel, the very thick flattish shortly umbonate operculum broader than the smooth calyx-tube, stamens yellowish, all fertile, anthers linear-oblong, dehiscing near the margin, style short, stigma scarcely dilated, *fruits* large urceolate-campanulate, the sulcate annulate rim slightly descending and broadly encircling the orifice, valves 3–4, deltoid, entirely included, fertile seeds winged, greatly exceeding in size the sterile ones.

In the mountains near Wigton (Queensland) Th. Wentworth Watson.

A tree attaining a height of at least 60 feet. *Bark* (according to the discoverer) persistent, wrinkled and sometimes scaly, red-brownish. *Mature leaves* 4–5 inches long, 1–1½ inches broad, opaque, papery-coriaceous. *Peduncles*, with pedicels in twos or fours, fairly strong. *Calyx-tube* (flowering) almost ½ inch long, often covered with little excrescences. *Operculum* distinctly broader than the calyx-tube, attaining at least ½ an inch in breadth, shining, sometimes very depressed and with a rather long umbo, sometimes rather convex and terminating gradually in a short point. The longer of the *stamens* measuring ⅔ inch, greatly exceeding the style. Anthers at least ½ a line long. *Calyx-tube* (fruit) an inch long, slightly contracted below the terminating margin. Vertex of the capsule smooth before dehiscing. *Seeds* brownish, shining; the fertile ones very much compressed, smooth, 2–3 lines long, margin acute. The species is called "Bloodwood" in its native place.

In our cultivated specimen the opercula are flat, as shown in the drawing. I do not think I have seen an umbo on them. The only cultivated specimen known to me is in the north-eastern part of the Botanic Gardens, growing with a westerly aspect and on rather shallow soil, overlying sandstone. It is about 40 years old, and was raised from seed of the type received by Baron von Mueller. It is about 50 feet in height, and at 3 feet from the ground the stem is 3 ft. 3 in. in circumference, or 13 inches in diameter. The trunk is single and erect, with an umbrageous canopy; the bark is of a dirty pale yellow colour, thick, not furrowed, scaly-fibrous, in thinnish layers. The superficial layers of the bark are deciduous, as in the case of the Yellow-barks. I have not seen a characteristic piece of the timber, and hesitate to damage our tree, but it is not a dark-coloured timber so far as we can see from small branches. The very young foliage is broadish and triplinerved, sparingly hairy, and not peltate.

RANGE.

This species is only recorded from " near Wigton, on a tributary of the Boyne River, in the Burnett district" of Queensland, according to " Eucalyptographia." We know little as to its distribution. The original description says, " In the mountains near Wigton," and I suggest, at a guess, that its home is in the Craig's Range.

I have received it from near Eidsvold (Dr. T. L. Bancroft), and also from Boondooma, Burnett district, 70 miles north-west of Wondai (S. J. Higgins, through C. T. White), and would suggest that our Queensland friends be on the lookout for it.

AFFINITIES.

1. With *E. urnigera* Hook.

"It is to be easily distinguished from *E. urnigera* by its very fine and abundant venation, by its paniculate flowers and distinctly larger fruits." (Translation of original.)

The principal resemblance between *E. Watsoniana* and *E. urnigera* arises from the fact that the fruits of both are urceolate. But reference to Plate 80, Part XVIII (for *E. urnigera*) shows that the detailed resemblance is not very strong. There is some resemblance in the buds, which is accentuated after shrinkage; the number of buds is fewer in *E. urnigera*. The foliage is different (although *E. Watsoniana* rarely suckers in Sydney, and my specimens are unsatisfactory). *E. urnigera* is a White Gum, and a native of a cold climate, wood pale, not Bloodwood-like, and the affinities of the species are with the *E. Gunnii* group and not with the Bloodwoods.

2. With *E. gomphocephala* DC.

". . . further as it is plainly different from all other species except *E. gomphocephala* on account of the breadth of the operculum, it is to be placed in the series of *E. corymbosa*." (Translation of original.)

Examination of Plate 92, Part XXI (for *E. gomphocephala*) shows that the two species are not closely related, although there are some general resemblances of buds and fruits. The venation of the leaves is different, *E. gomphocephala* is a Western Australian tree, *E. Watsoniana* is from Queensland. The former is a very large tree, strongly calciphile, and with short, fibrous bark like a shorn sheep; the timber is pale and interlocked.

3. With *E. maculata* Hook.

The relationship of this tree is with *E. maculata*, but the bark is totally persistent, the leaves are frequently a good deal broader, while their veins are finer and not quite so close, the flowers are often fewer and always conspicuously larger, the lid is ampler than the summit of the calyx-tube and seems to be simple from the commencement, although it exhibits considerable thickness; the fruits are of much larger size, rather expanded than contracted at the summit, with a flatter not suddenly quite descending rim, which latter is separated by a conspicuous circular channel from the tube of the fruit-calyx, while the seeds are larger and the fertile of these more angular. ("Eucalyptographia," under *E. Watsoniana*.)

This will be referred to when *E. maculata* is reached, in Part XLIII.

4. With *E. eximia* Schauer.

"Nearer still (than *E. maculata*) is the affinity to *E. eximia* which has likewise persistent and structurally similar bark, also a subtle venation of the leaves and comparatively large fruits" . . . ("Eucalyptographia," under *E. Watsoniana*.)

The affinities of these two species will be found dealt with in tabular form at p. 47.

5. With *E. corymbosa* Sm.

". . . the fruit bears close resemblance to that of *E. corymbosa*, a species otherwise very different, belonging to the series with hypogenous stomata and having smaller flowers with neither dilated nor polished lid." ("Eucalyptographia," under *E. Watsoniana*.)

For *E. corymbosa* see Plates 161 and 162, Part XXXIX. It has a deep red timber, while its bark is hard-flaky and darker in colour than that of *E. Watsoniana*. The buds are very different, while the fruits of *E. Watsoniana* are larger, and have a very different rim.

6. With *E. Abergiana* F.v M.

"*E. Watsoniana* recedes (from *E. Abergiana*) in narrower leaves equally coloured on either side, calyces with a varnish lustre and fixed to distinct stalklets, a widely dilated lid, which overreaches the orifice of the calyx-tube, longer stamens, fruits wider at the summit with a furrowed broader rim and unappendiculated seeds. ("Eucalyptographia," under *E. Abergiana*.)

"*E Abergiana* might in these comparisons be left out of consideration as it has stomata only on the lower page of the leaves, no flower-stalklets, and the lid separating from the tube of the calyx by irregular rupture, a narrower fruit-rim and appendiculated seeds. (*Op. cit.* under *E. Watsoniana*.)

For *E. Abergiana* see Plate 170, Part XLI. It has a non-yellow bark and a red timber. The buds are very different in shape, the fruits more sessile, less urceolate and with a different rim.

DESCRIPTION.

CCXXXI. E. trachyphloia F.v.M.

In *Journ. Linn. Soc.* iii, 90 (1859).

FOLLOWING is a translation of the original :—

A tree with angular branchlets, *leaves* alternate, moderately petiolate, narrow-lanceolate, subfalcate, narrowed into a fine point, opaque, faintly veined, with pellucid dots, intramarginal vein somewhat close to the edge. *Umbels* paniculate, 3–5 flowered, pedicels shorter than the peduncle, angled and the same length as the fruit. *Fruit* small, ecostate, truncate-ovate, three-celled, deltoid valves deeply included, seeds wingless.

On hills near the Burnett River (Queensland). Flowering September and October.

A medium sized tree, the bark persistent on the trunk and branches, ashy brown and rough, breaking into little pieces. Leaves 3–5 inches long, 5–8 lines broad, narrowed into a petiole of 6–9 lines, a little paler on the underside, fruit measuring about 3 lines, gradually contracted at the mouth.

Bentham then described it in B.Fl. iii, 221 :—

A moderate-sized tree, with a dark grey rugged bark, persistent. Leaves long-lanceolate, often falcate, 4–6 inches long, with very numerous fine parallel almost transverse veins, the marginal one close to or very near the edge. Flowers not seen. Fruiting-umbels several together in terminal panicles or in the upper axils, each with 3 to 6 pedicellate fruits. Fruit ovoid-truncate, contracted towards the orifice, about 3 lines long, the rim thin, the capsule deeply sunk.

It was described and figured by Mueller in the "Eucalyptographia," and he points out that while it attains a height of 80 feet, with a stem-diameter of 2 feet, ". . . . . in exposed situations on the tops of hills dwarfed in growth and fruiting already in a shrubby state."

The timber is pale-coloured, somewhat like Spotted Gum (*E. maculata*).

Dr. J. Shirley gives the aboriginal name as "Gou-unya" in use by the Koolaburra tribe, between Tarromeo and Nanango, South Queensland.

In constituting a forma *fruticosa* F. M. Bailey, *Queensland Agric. Journ.* xxv, July, 1910, p. 9, says :—

For many years may have been observed on the Glasshouse Mountain, a dwarf form of our "White Bloodwood." It flowers and fruits when only about 5 feet high, and is certainly a worthy plant for garden culture, and if thus brought into use would require some name whereby it might be distinguished from the common form of the species, hence I have attached to it the above name *fruticosa*. We, however, so far have no proof of seedling plants retaining the dwarf habit, yet there is no reason to suppose otherwise, for this may be looked upon as a sport, like many other variations in the genus. Baron von Mueller notices in his "Eucalyptographia," Decade 5, this mountain form, but does not mention any particular locality; it may, however, have been in this same place, for I believe that he and Walter Hill together did some collecting in that locality in the early days of Queensland.

I do not think it is necessary to give this a formal name, unless it be desired to similarly treat the remainder of the numerous species which, while normally trees, flower in a shrubby state.

RANGE.

The type came from the Burnett River (near Bundaberg), in Queensland, and in the "Eucalyptographia" it was only recorded by the author from central and south Queensland localities, viz. :—"In poor, hilly country, hitherto traced from Moreton Bay (Bailey) to the Burnett River (Mueller) and the Mackenzie River (Bowman, O'Shanesy), chiefly in the sandstone formation." In Queensland, however, it occurs as far north as Stannary Hills, west of Cairns, while since I now record it from Bathurst and Melville Islands, it will doubtless be found to occur on the Cape York peninsula, and in the Northern Territory generally.

Going south, it occurs in New South Wales, as far south as the Goulburn River and Denman district, occurring over a large area north and north-west, chiefly on poor sandy and rocky land, until Queensland is approached and the Queensland localities connected therewith.

New South Wales.

Murrumbo, 50 miles north of Rylstone, near the Goulburn River (R. T. Baker). On sandy conglomerate, probably Narrabeen beds, Baerami, 15 miles west of Denman (R. H. Cambage, 2636). "Plentiful all over the district on the sides and tops of the hills all over the district. The trees have the appearance as if recently rung, as the foliage is of a reddish-brown cast. Small trees 20–30 feet, 1–1½ feet, rough pale bark, timber brown, chippy, but hard. Locally known as Bloodwood." Gungal, near Merriwa (J. L. Boorman). The above three localities are in the same general area.

We are now in the vicinity of the North-west Line and its branches. Bloodwood, 50 feet, 4 feet. Parish Brigalow, county Pottinger (Forest Guard M. H. Simon). "Bloodwood, about 10 miles from Coonabarabran-Gunnedah road" (Dr. Jensen, No. 127). Coonabarabran-Baradine road, near Coonabarabran (W. Forsyth). About 3½ miles east of Bugaldi-Coonabarabran road (Dr. H. I. Jensen, No. 95). "Bloodwood. Bark lighter than *E. corymbosa*." Warrumbungle Range (E. H. F. Swain, No. 35). Arrarownie, Borah Creek, Pilliga Scrub (Dr. Jensen, No. 152). South-east Pilliga (E. H. F. Swain, No. 22). Central Pilliga on a sterile ridge (E. H. F. Swain, No. 15). Pilliga East State Forest, county Baradine (Gordon Burrow). On Sandhills. Up to 2 feet diameter. Narrabri (J.H.M.). East Narrabri (J. L. Boorman).

"Bloodwood. About 30 feet high, 4 feet girth. Associated with *E. crebra* and *Callitris calcarata*." Parish Terrergee, county Courallie, Moree district (E. H. F. Swain, No. 36). "Little Bloodwood," Ticketty Well, between Wallangra and Yetman (Forest Assessor A. Julius).

QUEENSLAND.

The following specimens were collected by Leichhardt.

1. Debillipalah.
2. Between Myall Creek and Byron's Plains (22nd May, 1843).
3. . . . hills, scarce, a slender tree of 3 feet (?), with a scaly bark (4th June, 1843).

Dr. John Shirley, of Brisbane, has kindly favoured me with the following comments on these three localities (1, 2, 3):—

1. Dibillipah is evidently Didillibah, near Woombye, on our North Coast Line, 62 miles north of Brisbane.

2. Between Myall Creek and Byron's Plains, 22nd May, 1843. Myall Creek is a tributary of the Condamine on the Darling Downs, not far from Oakey, a township on our Western Line, 120 miles from Brisbane. Byron Plains has been searched for by officers of our Survey Department, but with no result. This was not his only visit to this neighbourhood, as Stuart Russell ("Genesis of Queensland," p. 360) reports:— "On my return to Cecil Plains (38 miles from Oakey) alone, one afternoon in the middle of 1844 (just before Leichhardt left for Port Essington) I saw a surprising object . . . a veritable chimney-pot hat . . . 'twas Dr. Ludwig Leichhardt's."

3. . . . Hills. Where was he 4th June, 1843?

No works to hand will solve this; but he collected mainly on the coastal country north of Brisbane in the early part of 1843, and on the Downs in the latter half.

4. Leichhardt's label on another specimen is "'Gala' tree, very similar to the Bloodwoods in the Sandy Mountain Range, Archer's Station, 23rd September, 1843." The Rev. Dr. Lang ("Cooksland," p. 83), quotes a letter from Dr. Leichhardt, dated the 4th of the same month from "Archer's Station, Bunya Bunya." I would suggest that Leichhardt named the tree because of the parrots called Galahs (*Cacatua roseicapella*) which frequent this and other Bloodwoods because of the profusion of honey-yielding flowers.

Following are some specimens by later collectors:—

"White Bloodwood, with broadish leaves," South Queensland (Forest Inspector Board). Eight-mile Plains, just south of Brisbane (A. Murphy, J. L. Boorman). Brisbane (J.H.M.). Ipswich-road, near Brisbane, common (C. T. White).

Chinchilla (R. C. Beasley). (We want more localities on this railway line.)

"Bastard Bloodwood," Taylor's Range (F. M. Bailey). The forma *fruticosa* of F. M. Bailey. Common on top of Mount Ngun Ngun, Glass House Mountains (C. T. White, J. Shirley).

Maryborough (W. H. Simon) "White Bloodwood." "Fairly large trees of 40–60 feet, stems 2–4 feet. Bark whitish, flaky, or even of a Stringybark nature. Timber not much esteemed locally." Bundaberg, close to the type locality. (J. L. Boorman, J.H.M.)

Near the Comet River (P. O'Shanesy).

Rockhampton, with a spherical gall 1¼ inches in diameter, identical with or closely resembling *Brachyscelis pomiformis*, see Part XL, p. 318. (J.H.M.)

" Bloodwood," Stannary Hills. (Dr. T. L. Bancroft.)

Percy Island, west of Mt. Armitage. " Small tree, 20 feet "; Middle Percy Island; low trees growing thickly together, south-east of Middle Percy Island (Henry Tryon).

NORTHERN TERRITORY.

" Large Bloodwood. This species grows in the open forest country with *E. miniata* and *E. tetradonta* on both Melville Island and Bathurst Island. Examples are found on the gentle slopes and along the little streams falling from the higher country to the main waterways, *i.e.*, the tidal estuaries." Bathurst Island (G. F. Hill, No. 465).

This is the first record, so far as I am aware, from the Northern Territory, and we must therefore connect this and the North Queensland localities.

AFFINITIES.

1 and 2. With *E. siderophloia* Benth., and *E. crebra* F.v.M.

" *E. trachyphloia*, placed by Bentham between *E. siderophloia* and *E. crebra*, is much nearer allied to *E. terminalis* and *E. dichromophloia* (as shown in the *Fragm. Phytogr. Austr.* xi, 43–44), along which species it was placed already in the *Journ. Linn. Soc.* iii, 90." (" Eucalyptographia," under *E. siderophloia*).

In the same work, under *E. trachyphloia*, he also compares it with *E. crebra* in the following words :—

" . . . *E. trachyphloia* approaches *E. crebra* and some cognate Ironbark trees, all of which have the stomata isogenous and show a clear line of dehiscence, by which the lid is separated, while the difference of the anthers separate them even sectionally according to Bentham's system. Besides, in *E. crebra* the lid is not depressed, the fruit is not or less contracted at the summit, and the valves are almost terminal."

For *E. siderophloia* turn to Plate 47, Part X of the present work, and for *E. crebra* to Plate 53, Part XII. But both these are Ironbarks, and it seems inadvisable at this place to stop to make comparisons between Ironbarks and a Bloodwood, the relationships being so distant.

3. With *E. tessellaris* F.v.M.

This species shares in some of the characteristics of *E. trachyphloia*, but irrespective of the discrepancies of the bark differs already in the uniform coloration of the leaves, which latter are also generally longer, are less pointed and show more distinctly the venation; moreover, the inflorescence is less expanded; the lid is larger and separates by a more sharply defined sutural line from the other portion of the calyx; the fruits are also of greater size, though less hard; the fertile seeds are much larger, comparatively more compressed and distinctly margined; but the last-mentioned characteristic is not well expressed in the lithographic illustration of *E. tessellaris* now offered, figure 9 having been drawn from unripe seeds. (" Eucalyptographia," under *E. tessellaris*.)

For *E. tessellaris*, see Plate 156, Part XXXVIII. The juvenile leaves are narrow, the flower buds clavate and decurved. The chief similarity is in the fruits, which much resemble each other in size and outline, but they are otherwise very different. One can readily crush the fruits of *E. tessellaris* between the fingers, as their walls are papery like those of *E. clavigera* and its allies; those of *E. trachyphloia* are much more strongly built. The trees are very dissimilar in appearance, *E. tessellaris* having tessellated bark (and smooth upwards) as its name denotes, while that of *E. trachyphloia* has a flaky fibrous bark throughout, with a yellowish cast.

4. With *E. dichromophloia* F.v.M.

Its real systematic place should be next to *E. dichromophloia*, from which it can be distinguished in rougher bark, in thinner less elongated leaves of a darker green above, and dull paleness beneath (therefore not of equal colour on both sides), with recurved edge, in the want of stomata on the upper page of the leaves, in the calyces of less polished smoothness, in smaller fruits with perhaps never or only rarely four valves, and in the absence of any appendage to the fertile seeds. ("Eucalyptographia," under *E. trachyphloia*.)

For *E. dichromophloia*, see Plate 165, Part XL. Its affinity to *E. trachyphloia* is not as close as Mueller thought it was. *E. dichromophloia* has a red timber, and a reddish, flaky bark. The juvenile foliage of *E. dichromophloia* is described at Part XLI, p. 3.

The affinity of *E. trachyphloia* is with the Yellow Barks. *E. eximia, peltata, Watsoniana,* and *trachyphloia* are Yellow-barks ; all have barks fibrous-flaky and more or less yellow, and timbers palish in contrast to reddish, such as that of *E. corymbosa.* These Yellow-barks are more stringy than those of the generality of those of the Bloodwoods (which are more flaky); in this respect they display affinity to the Peppermints and even to the Stringybarks. The following table shows some of the characters contrasted, so far as it is possible to contrast species so closely related :—

	eximia.	*peltata.*	*Watsoniana.*	*trachyphloia.*
Juvenile leaves	Peltate	Peltate	Unknown	Peltate, more hirsute than the others.
Mature leaves	Tendency to large size.	Medium size ...	Medium size ...	Tendency to small size.
Buds	No pedicels; medium size; conical opercula.	Hardly any pedicels; smaller than *E. eximia*; conical opercula.	Short pedicels; rather large; nearly flat opercula.	Distinct and even moderately long pedicels; small; sub-conical opercula.
Fruits... ...	Medium size; ovoid, less rarely urceolate.	Small, ovoid ...	Rather large; distinctly urceolate.	Small, slightly urceolate.

DESCRIPTION.

CCXXXII. E. hybrida Maiden.

In *Journ. Roy. Soc. N.S.W.*, xlvii, 85 (1913).

Following is the original description :—

Arbor erecta, altitudine circiter 50 pedes. Cortex cinerea, laevis, corrugata. Lignum pallidum durum. Folia matura lanceolata vel late lanceolata, pallida virentia, tenuiora, circiter 8–12 cm. longa, vena peripherica margini approximata, venis lateralibus patentibus. Flores in breve panicula corymbosa, quaque plerumque 3–6 flora. Calycis tubus conoideus. Operculum acuminatum, calcis tubo aequilongum. Fructus cylindrico-conoidei, circiter 6 mm. lati, in orificium leniter contracti, margine tenui. Valvarum apices plusve minusve depressi, orificium rare tangentes.

An erect tree of about 50 feet high, the tips of the branches smooth, the butt with a sub-fibrous (peppermint-like) or flaky-fibrous and more or less flat-corrugated bark, greyish or blackish externally, hence some trees have been described as " Black Box."

Timber pale-coloured, hard, interlocked, and probably valuable.

Juvenile foliage not seen in the strictly opposite state, but as seen, not different from the mature foliage except in width.

Mature foliage.—Lanceolate or broadly lanceolate, slightly falcate, acuminate, commonly 8 to 12 cm. long. Dull green, the same colour on both sides, rather thin and tough, lateral veins spreading, fine, the intramarginal vein not far removed from the edge of the leaf, oil dots not numerous.

Flowers.—Peduncles of moderate length, angular, usually in a short corymbose panicle, each with about three to six or sometimes more flowers. Calyx-tube conoid, 5 cm. diameter, often angular, tapering into a short pedicel. Operculum pointed and as long as the calyx-tube. Stamens inflected in the bud, anthers, small, yellow, opening in small slits near the top, filaments at base, and small gland at back, indubitably showing intermediate characters between the anthers of *E. paniculata* and *E. hemiphloia*.

Fruit.—When immature cylindrical, with a rim round the orifice; when ripe cylindrical to almost conoid, about 6 mm. in diameter, hardly constricted at the orifice, rim thin, tips of valves more or less sunk and rarely flush with the orifice.

RANGE.

Type from Concord, Sydney, N.S.W. (Rev. Dr. Woolls, 1890; R. H. Cambage, 10th February, 1901). It was originally found in Bray's Paddock, Concord, near Sydney, where I knew of six trees until recently, but building operations may soon exterminate these particular specimens.

Dr. J. B. Cleland has drawn my attention to a tree on Milson Island, Hawkesbury River (a short distance west of the Railway Bridge), which appears to be identical with that from Concord. *E. paniculata* Sm. is common on the island, but there is no *E. hemiphloia*. This suggests that the hybrid originated elsewhere than on Milson Island.

AFFINITIES.

The affinities of this species are almost intermediate between *E. paniculata* Sm., the Grey Ironbark, and *E. hemiphloia* F.v.M., the Grey Box.

This is the first species of this genus which has been named with especial reference to its hybrid character. I have a large number of instances of apparently indubitable hybrids. In most cases a pictorial illustration is necessary to make the hybridism clear, and I propose to describe them in this work when dealing with hybridism as a special subject.

Following is the first passage referring to this particular tree. The Cabramatta tree is the plant afterwards described as *E. Beormani* Deane and Maiden (see Part X, p. 330 of the present work). Its affinity is with *E. siderophloia* Benth. rather than with *E. paniculata* Sm. The Ironbark in Mr. Bray's paddock at Concord is *E. hybrida*.

The Ironbark group (Schizophloiæ) is less liable to variation in the nature of its bark than any of the preceding sections; and yet in some forms of *E. paniculata* the bark is less rough and deeply furrowed than in its allies, whilst in exceptional cases, when it goes under the popular names of "Ironbark Box" and "Bastard Ironbark," the wood and fruit are those of Ironbark, but the bark less rugged. Some years ago, when the late Mr. Thomas Shepherd was residing with Mr. Bell, at Cabramatta, he called my attention to a tree which, so far as its general characters were concerned, appeared to be an Ironbark, the shape of the buds, flowers and fruit being similar to those of *E. paniculata*, and the wood being, in the opinion of the workmen, like the ordinary Ironbark of the neighbourhood. Mr. Shepherd called the tree "Black Box" and "Ironbark Box," and entertained an idea that it might be an undescribed species. Although I have had specimens of this tree for some years, it is only of late that I have come to the conclusion that the tree in question is really an Ironbark, for on Mr. H. Bray's property at Concord a similar one has been pointed out to me. This the workmen called "Bastard Ironbark," as the wood resembles that of Ironbark, whilst the bark is not furrowed as Ironbarks usually are, but is more like that of Box or Woollybutt. Having examined the fruit and leaves of this tree, and having ascertained that the wood is similar to that of Ironbark, I am now convinced that the tree which puzzled Mr. T. Shepherd and that growing in Mr. Bray's paddock are identical, both of them being varieties of *E. paniculata*. If hybridisation were possible in the genus, one would think that the "Ironbark Box" is a cross between Ironbark and Box, but according to the opinion of the late eminent naturalist W. S. Macleay, F.L.S., the impregnation of the flowers takes place before the operculum falls off, and hence in such a case crossing cannot be effected. As this matter has never been carefully investigated by any observer, nothing like certainty can be affirmed of the probability or improbability of hybridisation. (Rev. Dr. W. Woolls in *Proc. Linn. Soc. N.S.W.*, xvi, 60–61, 1891.)

Ten years later Mr. Henry Deane and I drew attention to a Eucalypt which we had received from Mr. R. H. Cambage, and which we thought presented an instance of hybridism. This was the identical tree from Mr. Bray's paddock at Concord.

We are indebted to specimens of a species from Concord from Mr. R. H. Cambage, and the examination of the specimens from the point of view of hybridisation is so instructive that we relate it in detail. Mr. Cambage stated that his tree was growing among *E. paniculata* Sm. (another of the Ironbarks), with *E. hemiphloia* near. He added: "The fruits look like those of *E. paniculata*, but the bark is not that of an Ironbark. The bark is as smooth as that of *E. hemiphloia*, and continues right up among the branches." Reference to the herbarium of the late Dr. Woolls showed that he had, many years previously, obtained specimens from the same locality, and following is a copy of his label: "*E. paniculata*, Bastard Ironbark. Bark something like Woolly Butt or Box." The immature fruits have rims which remind one

of those of *E. melliodora*, and while seized of its affinities to *E. paniculata*, *E. siderophloia* and *E. hemiphloia*, there was certainly evidence to look upon it as an aberrant form of *E. melliodora* and also of *Bosistoana*, an affinity which (as regards the latter species) had already been arrived at by Mueller (though in a different way) as regards the Cabramatta specimens. The fruits are a shade smaller than those of some specimens in our possession, and we have from time to time looked upon the tree as a possible hybrid between *E. paniculata* and *E. hemiphloia*, and *E. paniculata* and *E. melliodora* respectively. We have examined the trees referred to by Dr. Woolls and Mr. Cambage, and are of opinion that, while they may be properly described as " Black Box " and " Ironbark Box," there are certain points of difference between them and the Cabramatta trees (*E. Boormani*) which make us hesitate in referring them to the same species. The foliage and fruits are less coarse than those of Cabramatta, and this circumstance, coupled with the fact that the trees grow amongst *E. paniculata*, may cause some observers who may be inclined to look upon the Concord trees as hybrids to consider that *E. paniculata* is one of the parents. Bearing in mind that cases of hybridisation amongst Eucalypts usually break down under fuller examination, we hesitate to believe that we have a case of hybridisation here, and will revert to the subject at some future time.

Four years later I stated that I had no doubt as to its hybrid nature. I had had the tree under observation in the meantime, and was of opinion that it was a form sufficiently distinct to receive a name.

E. paniculata Sm. × *hemiphloia* F.v.M. In these Proceedings (1901, p. 340) Mr. Deane and I referred, though with some doubt, to a " Black Box " or " Ironbark Box " from Concord, near Sydney. I desire to say that, having kept these trees under observation, I have no doubt as to their being hybrids of the species named. (*Proc. Linn. Soc. N.S.W.*, xxx, 498, 1905.)

Eight years later still, I described the tree under the name *E. hybrida*.

DESCRIPTION.

CCXXXIII. E. Kruseana F.v.M.

In *The Australian Journal of Pharmacy* (Melbourne), 20th August, 1895, p. 233.

It was described under the heading of " Description of a new Eucalyptus from south Western Australia." Following is the original description :—

Branchlets terete; leaves small, opposite, sessile, mostly cordate-orbicular, some verging into a renate form, on both sides as well as the branchlets, peduncles, pedicels and calyces whitish-grey, copiously glandular-dotted, the venules faint, the peripheric close to the edge of the leaves; peduncles compressed, axillary, 3–4 flowered, about half as long as the leaves; pedicels variously shorter than the whole calyx, sometimes quite abbreviated; flowers small; tube of the calyx at first almost hemiellipsoid; operculum semiovate-conical, slightly pointed, about as long as the calyx-tube; filaments yellowish-white, inflected before expansion; anthers somewhat longer than broad, opening by longitudinal slits; stigma hardly broader than the style; fruit-bearing calyx globular semi-ovate, devoid of angulation, contracted at the summit, the rim narrow; valvules enclosed, but nearly reaching the orifice, usually four. Height of the plant unrecorded, but probably of shrubby stature. Leaves firm, of $\frac{3}{4}$–$1\frac{1}{4}$ inch measurement. Calyces, inclusive of the lid, hardly above $\frac{1}{3}$ inch long. Fruit-calyx as broad as long, measuring fully $\frac{1}{3}$ inch. Matured seeds as yet unavailable.

It was named in honour of the late Mr. John Kruse, of Melbourne.

SYNONYM.

E. Morrisoni Maiden.

I described *E. Morrisoni* in the *Journ. Nat. Hist. and Science Soc. of W.A.*, vol. iii, p. 44 (1910). I find that the two species are identical, and therefore *E. Morrisoni* must fall. I endeavoured to see Mueller's type many years ago, but it was detained by Mueller's trustees for a number of years, and was not seen by me until Prof. Ewart showed it to me in August, 1911. (*Proc. Roy. Soc. N.S.W.*, xlix, 328, 1915.)

Inasmuch as the description of *E. Morrisoni* usefully supplements that of Mueller's in certain points, I give it here. *E. Kruseana* was described with 3–4 flowers, *E. Morrisoni* up to 7. There are lesser differences.

A straggling shrub, about 8 feet high. One patch seen 50–150 miles east of Kalgoorlie, Trans-continental Survey. Collected by Henry Deane, M.A., M.Inst.C.E., Consulting Engineer, May, 1909.

Frutex ramis sparsis circiter 2–5 m. altus. Folia glauca, coriacea, conferta, orbiculata, 1–2 cm. diametro, amplexicaula, inconspicue venosa.

Flores conferti in fine ramorum umbellis usque ad 7 in capitulo, brevissime pedicellati. Calyx subconicus, sine angulis, gradatim in pedicello, operculum simile forma magnitudineque.

Filamenta sulphurea, antherea duabus cellis didymis, glandula magna.

Fructus subcylindricus, circiter 6 mm. longus 5 vel 6 mm. latus.

Capsula mersa sub orificio.

Videtur *E. pulvigeræ* forsan approximandus.

Juvenile leaves.—No very young leaves collected. Probably there is no difference between the juvenile and mature leaves.

Mature leaves.—Glaucous on both sides, coriaceous, crowded, the branchlets rounded. All nearly orbicular and varying in diameter from about 1 to 2 cm. slightly amplexicaul, apex usually absent or slightly emarginate. Midrib moderately conspicuous for the basal half of its length, lateral veins anastomosing. Incipient crenulations on the margin in some leaves.

Buds and Flowers.—Crowded at the ends of the branchlets in umbels up to seven in the head. Very shortly pedicellate, the common peduncle short also. Calyx conoid, not angular, tapering gradually into the pedicel; the operculum similar in shape and size, often bent or curved at the top.

Filaments yellow, the anthers with two parallel cells joined together for their whole length, and with a very large gland at the back.

Fruits.—In branchlets forming a compound panicle, the individual fruits subcylindrical, about 6 mm. long and 5 or 6 mm. broad, sharply separated from the pedicel. Capsule well sunk below the orifice, valves three or four.

In honour of Dr. Alexander Morrison, formerly Government Botanist of Western Australia, who has done so much to diffuse a knowledge of the vegetation of his State.

(The notes on the leaves will be seen under "Affinities" at p. 53.)

RANGE.

It is confined to Western Australia, so far as we know at present.

The type came from Fraser's Range (J. D. Batt), while Mueller's locality for the type is given in the description as "Fraser's Range, South Western Australia." The specimen itself bears the inscription, "100 miles north of Israelite Bay," and doubtless refers to the same locality. My locality for *E. Morrisoni*, "50–150 miles east of Kalgoorlie," Transcontinental Railway Survey, is new, but is in the same general locality as the preceding. (Maiden in *Journ. Roy. Soc. N.S.W.*, xlix, 329.)

I have not seen a specimen from any other locality, and invite attention of collectors to this dainty-foliaged small species.

AFFINITIES.

1. With *E. Perriniana* F.v.M.

Related to *Eucalyptus gamophylla*, *E. orbifolia*, and *E. Perriniana*. The latter (last), however, is from cold mountain regions of Tasmania, and its leaves, free from each other only in the early stage of the young plants, become connate when the trees attain some height, they then resemble those of *E. Risdoni* (probably the *Euc. perfoliata* of Desfontaines), although the species belongs to the series of Parallelantheræ. (Original description.)

For *E. Perriniana* see Part XXVI and Plate 108. All the leaves of that species are not isoblastic ; a lanceolate leaf is figured at 1d, Plate 108. The leaves of *E. Kruseana* are much smaller, and, so far as we know, the juvenile leaves are neither connate nor perfoliate. *E. Perriniana* is a larger plant (though not very large), with flowers apparently always in threes, and with larger, hemispherical fruits.

2. With *E. gamophylla* F.v.M.

E. gamophylla is likewise separated from the present new species by the concrescently paired leaves; moreover its pedicels are almost obliterated, the fruit-bearing calyces are much longer than broad, bearing the valvules at a higher insertion. (Original description.)

For *E. gamophylla* see Part XXXV, with Plate 147. This again is a perfoliate species, succeeded by narrower lanceolate leaves ; the leaves are not orbicular. The inflorescence is more paniculate and the fruits more cylindroid, while it is a tree yielding timber at least 8 inches in diameter.

3. With *E. orbifolia* F.v.M.

The differences of *E. orbifolia* are obvious, consisting in scattered stalked leaves, larger flowers, semiglobular calyx-tube, proportionately longer operculum and exserted fruit valvules. (Original description.)

For *E. orbifolia* let us turn to Part XVII, with Plate 74. We know but little of the species, but it is sufficient to say that they are very different.

Following is an addendum I gave to my description of *E. Morrisoni* :—

A few additional notes will be found in square brackets. The general question of the comparative morphology of the leaves of all species remains to be presented when the subject of Morphology is reached.

" *E. Morrisoni* belongs to the somewhat heterogeneous group (as regards affinities) of species with perfoliate or otherwise strictly opposite (sessile) leaves in the mature stage.

It would appear from B.Fl. iii, 187, that Bentham did not attach much importance to shape of sucker or juvenile leaves.

Nevertheless, he used these young leaves to some extent for classification purposes, *e.g.*, " Leaves in the young saplings of many species and *perhaps all in some species* " [my italics] " horizontal, opposite, sessile and cordate." (B.Fl. iii, 185.)

Some species so included in Bentham's time are now known not to be sessile throughout life, and it is very possible that, as time goes on, it will be found that all Eucalypts are heteroblastic (*blastos*, a shoot), *i.e*, having juvenile leaves different from mature ones. This, if proved, will come about in two ways, by (*a*) the discovery of two kinds of leaves on existing isoblastic species, or (*b*) the discovery of two species (now accounted isoblastic), one with cordate, &c., leaves entirely, and the other with usual falcate, &c., leaves entirely to be conspecific.

We have much to learn in regard to the effect of changed environment on different species of Eucalyptus, and experiments in cultivation have thrown, and will continue to do so, much light upon variation in this direction.

So far as I know, the only species of Eucalyptus (in addition to the present one) which are isoblastic are :—

1. *E. pulvigera* A. Cunn. A rare New South Wales species. [By this *E. pulverulenta* Sims is meant. See Plate 91, Part XXI of the present work.]

2. *E. cordata* Labill. A Tasmanian species. [See Plate 84, Part XIX.]

3. *E. macrocarpa* Hook. A very coarse Western Australian species. [See Plate 77, Part XVIII. In *Journ. Roy. Soc. N.S.W.*, liii, 70 (1919), I have drawn attention to the fact that there is a tendency to heteroblasticity in this species.]

4. *E. pruinosa* Schauer. Indigenous to Western Australia, North Australia, North Queensland. (I have seedlings of this species raised from seed collected by Prof. Baldwin Spencer, at Whanalowra (?), Northern Territory, in 1903, which are distinctly pedicellate!) [See Plate 54, Part XII.]

5. *E. ferruginea* Schauer. With sessile, cordate, rusty pubescent leaves—an Angophoroid species from Western Australia and North Australia.

6. *E. setosa* Schauer. A sessile, cordate, Angophoroid species, with bristly branchlets, from Queensland and North Australia. [The figures on Plate 158, Part XXXVIII, show that *E. setosa* cannot be longer considered as isoblastic, and that Plate 159 shows that *E. ferruginea* is becoming heteroblastic, and that probably more active observation will produce additional evidence in that direction.]

Then we have, in a class by itself :—

7. *E. perfoliata* R.Br., with very large perfoliate, connate leaves and fruits. In this case two opposite leaves cohere into a single lamella, which is pierced by the stem. From Western Australia. [See Part XLIV.]

8. *E. gamophylla* F.v.M., as figured by Mueller in " Eucalyptographia," shows no stalked leaves, but it becomes eventually lanceolate and very shortly stalked. See a specimen from Central Australia, collected by C. Winnecke about 1884 (Herb. Melb.), thus leaving *E. perfoliata* the only connate-leaved species to date. [See Plate 147, Part XXXV of the present work.]

9. *E. peltata* Benth. is worthy of special mention. Its leaves are alternate, peltately attached to the petiole above the base, and broadly ovate. This unique species is figured in " Eucalyptographia," and morphologically it is an incipient

form of the connate-petiolate leaf. [The "Eucalyptographia" plate is erroneous. The adult leaves are not peltate, but lanceolate, as is shown in the present Part. See p. 33 above.]

Therefore our new species presents affinities to *E. pruinosa* Schauer, *E. pulvigera* A. Cunn., *E. cordata* Labill., *E. macrocarpa* Hook., *E. ferruginea* Schauer, and *E. setosa* Schauer.

It differs from all of them in colour of the filaments, from *E. macrocarpa* it is sharply separated in the size and shape of the fruits, from *E. ferruginea* and *E. setosa* in the leaves, fruits, vestiture, &c.

Then there remain *E. pulvigera*, *E. cordata*, *E. pruinosa*.

From *E. pulvigera* it differs in the very much larger leaves of that species, in the shape of the buds, slightly in the anthers (see below), in the fruits in threes. The fruits are also very much larger, more hemispherical, with a defined rim, and are sessile on a common peduncle.

From *E. cordata* it differs in the foliage (larger even than *E. pulvigera*), in the fruits, which are large and almost hemispherical ; the other characters are those of *E. pulvigera*.

The anthers of *E. pulvigera* and *E. cordata* are identical. They also very strongly resemble those of *E. Morrisoni*, but they appear to differ in having a smaller gland and in being more versatile.

From *E. pruinosa* it differs in the very much larger leaves (usually elliptical or tending to lanceolate), larger and more numerous flowers and fruits. The fruits also have a well-defined rim, and, like the branchlets and pedicels, are more or less angular. The two species are sharply different in the anthers, which, in the case of *E. pruinosa*, belong to a section with a small gland at the top and small openings of anthers."

DESCRIPTION.

CCXXXIV. E. Dawsoni R. T. Baker.

In *Proc. Linn. Soc. N.S.W.*, xxiv, 295 (1899), with a Plate (XXI).

E. Dawsoni is referred to at Part XIII, p. 109 of the present work (1911), but is there looked upon as a synonym of *E. polyanthemos*. In Part LIX, p. 242, of my "Forest Flora of New South Wales" (1916) I was inclined to recognise *E. Dawsoni* as a separate species, but hesitated, for reasons stated. I have now come to the conclusion that *E. Dawsoni* is sufficiently distinct.

Following is the original description :—

A tall tree with a smooth bark, the foliage, branchlets, buds and fruits glaucous. Young leaves broadly lanceolate 6 inches long and over 3 inches wide, on a petiole over an inch long, very obtuse, glaucous on both sides, venation distinct. Mature leaves mostly short, oblong-lanceolate, very obtuse, rarely acuminate, occasionally reddish in colour, venation fairly distinct, lateral veins not distant, intramarginal vein close to the edge. Peduncles axillary but mostly in large terminal corymbs, exceeding the leaves. Buds on *young trees* 3 lines long, 1½ lines in diameter, sessile or on short pedicels; operculum hemispherical, obtuse; on mature trees 4 to 5 lines long, 1 line in diameter, the calyx tapering into a filiform pedicel, operculum conical, acute. Ovary domed at the summit. Stamens all fertile, inflexed in the bud, filaments thick in proportion to the diameter of the anthers. Anthers very small, cylindrical, rounded at the base and truncate at the top, opening by terminal pores. Fruit small, turbinate, pedicel almost filiform, mostly a line in diameter and under 2 lines long, rim thin, capsule sunken, valves not exserted.

Illustrations.

It is figured (as *E. polyanthemos*) in Plate 58 (Part XIII) of the present work, under the following figures :—4, 9, 10, 11. With the figures now submitted (5–8, Plate 175) it is suggested that the characters of the species are clear.

SYNONYM.

None, but hitherto included by me in *E. polyanthemos*. It is undoubtedly a geminate species.

RANGE.

The species is confined to New South Wales as far as we know. In the original description we have the following localities. "Ridges on the watershed of the Goulburn River (R. T. Baker); across the main Divide at Cassilis, and north-west to Pilliga (Prof. W. H. Warren)."

To which may be added the following, some of which are supplementary localities.

Bylong, 32 miles from Rylstone (R. T. Baker). The type. Also Murrumbo. "Red Box, Slaty Gum," Gulgong (J. L. Boorman and J.H.M.).

Cobborah (between Dubbo and Dunedoo) (District Forester Marriott). Dunedoo (Forest Guard C. H. Gardner).

"Red Gum Nos. 1 and 2." Murrurundi (Forester L. A. Macqueen, 1913). Baerami, Denman (R. H. Cambage, Nos. 2710, 2711).

The following specimens of *E. Dawsoni* in the National Herbarium, Melbourne, were looked upon by Mueller as *E. polyanthemos*. "Ridges near Mudgee" (Rev. Dr. Woolls, October, 1886); Mudgee road (Woolls), under *E. polyanthemos* in B.Fl. iii. 214.

AFFINITIES.

With *E. polyanthemos* Schauer.

I think that Part XIII, p. 114, &c., of this work, and Part LIX, p. 214, &c., of my "Forest Flora of New South Wales" are eloquent as to the affinities of the two species.

Mr. Baker, in his original description of the species (*op. cit.*, p. 296) does not clearly contrast it with others. Speaking of it and *E. polyanthemos* he says:—"The sucker and mature leaves of both species are different as well as the venation. The leaves of *E. Dawsoni* are almost always glaucous, as well as the buds and fruits, a feature rarely found in *E. polyanthemos*."

The describer speaks of *E. Dawsoni* as a tree with a smooth bark—growing "to a great height with a splendidly straight, branchless trunk, and always occurs under the ridges, never being found on the summit nor at the base." It seems to me that the most outstanding differences between the two species consist in the larger size, the more erect habit, and the smoother bark of *E. Dawsoni*.

I cannot satisfy myself that there are important differences in the juvenile leaves of the two species; the mature leaves are more commonly orbicular, or comparatively broad, in *E. polyanthemos*, the foliage of *E. Dawsoni* being more commonly lanceolate.

The fruits of *E. Dawsoni* appear to have thinner walls, and to be more conical than those of *E. polyanthemos*; the latter are usually more pear-shaped. At the same time the fruits are often so similar that they are not easily separated.

The staminal ring (fig. 7*a*, Plate 175) seems more deciduous, with the stamens attached, in *E. Dawsoni* than in *E. polyanthemos*, but this is a matter for investigation with additional material.

DESCRIPTION.

LXII. E. polyanthemos Schauer.

For a description of this species, see p. 109, Part XIII of this work. It will be observed that, at p. 56 of the present Part, *E. Dawsoni* R. T. Baker has been recognised as a species distinct from *E. polyanthemos.*

Illustrations.

In Plate 223, Part LIX of my "Forest Flora of New South Wales," I figured the type specimen of *E. polyanthemos* Schauer.

Most of the leaves are orbicular, and I find that the plate is incomplete to the extent that I did not also figure the lanceolate leaves which are often found on trees bearing orbicular and broadly lanceolate leaves as on the type.

If, however, Plate 58 of Part XIII of the "Critical Revision" be turned to, it will be found that (as explained at p. 56) while figures 4, 9, 10, 11 are *E. Dawsoni*, and show lanceolate leaves, Nos. 3, 5, 8 also show lanceolate leaves, and are true *E. polyanthemos.*

The Bark.

The "North of Bathurst" tree (the type of *E. polyanthemos*) has a more or less rough, flaky bark, but it varies, within limits, as to the amount of fibre and the distance the roughness reaches up the bole. See also Cudal (W. F. Blakely), Hill End (R. H. Cambage), p. 61, for local descriptions more or less full.

The north-east of Victoria and the southern New South Wales tree was described by the late Dr. A. W. Howitt as having a "gnarled, greyish boxy bark" and "bark grey, persistent, and looks often scaly." "At first sight the tree resembles somewhat *E. hemiphloia* variety *albens* in its bark." Mr. Baeuerlen, speaking of trees near Bombala, N.S.W., says, "bark light or yellow-grey, fibrous, persistent except on the topmost smallest branchlets."

Speaking of the Tumberumba district, N.S.W., Mr. R. H. Cambage says:—"In comparing these trees with the Victorian and Bathurst Red Box, they appear to more nearly resemble the former, but this is chiefly owing to their having Box bark covering the trunk and limbs. The fruit might belong to either, while, from a cursory examination, the red timber of all three appears the same. In foliage, however, the Kycamba trees closely resemble the Bathurst Red Box, which has been described by R. T. Baker under the name *E. ovalifolia* (these Proceedings, 1900, p. 680). (*Proc. Linn. Soc. N.S.W.*, xxix, 687.)

See also the description of the bark under Wyndham (J. L. Boorman); near Albury (Bishop J. W. Dwyer); Canberra (R. H. Cambage).

The use of the term Box as applied to this tree has caused some confusion. The earliest settlers probably applied the name to a half-barked sub-fibrous barked tree, which Sydney people know as Box (*E. hemiphloia*). Later settlers, in the drier parts, refer to a bark which is often less fibrous and more flaky, *e.g.*, as is often seen in *E. melliodora*. I have seen the trees over much of the range of the species in New South Wales and Victoria, and am satisfied that the "north of Bathurst" (the type) and the Southern Tableland (and Victorian) trees do not really differ in bark. There are, of course, differences in the barks as regards individual trees, particularly in localities far apart, as one would naturally expect.

E. polyanthemos has lanceolate leaves.

The following specimens were seen by Mueller and labelled by him *E. polyanthemos*; all have lanceolate leaves, which indeed are often seen on the upper branches of the species. It is, indeed, a matter of common observation that towards the top of an adult tree the leaves become smaller or more lanceolate. This has been already referred to under "Illustrations."

Mr. R. H. Cambage (*op. cit.*) points out the variation in the leaves of this species. Besides the examples to be immediately cited, see the references under "Range" to the Federal Territory leaves (Weston, Cambage), and Hill End (Cambage).

1. "Den." Narrow-leaved Grey Box. The young saplings have round blue leaves, the old trees as within [*i.e.*, lanceolate leaves.—J.H.M.]. Bark grey, persistent, and looks often scaly. The smallest branches are smooth. This tree when young often grows as a number of saplings from the same root. The trunk has often swellings and knobs, and is frequently largest just where it springs from the ground (Iguana Creek, Gippsland, A. W. Howitt, No. 10).

As to the use of the name Den, see the present work XIII, p. 109. These specimens show that, even if this aboriginal name is given to another species, it is certainly applied to *E. polyanthemos*.

2. In "*E. polyanthemos*, Snowy River, Gippsland (R. Rowe per Charles Walter)," the leaves vary from broadly lanceolate to lanceolate and even narrow-lanceolate. There are no orbicular leaves amongst them.

3. Mudgee road, N.S.W. The specimen is identical with Schauer's, but the sender [not named.—J.H.M.] writes: "In the larger trees the leaves are ovate-lanceolate."

Other specimens in the Melbourne Herbarium including lanceolate leaves are:—Daylesford (J. R. Tovey); County of Talbot (F. M. Reader). Both Victoria.

RANGE.

This has already been described at pages 112–115 of Part XIII. In view of the confusion that has gathered about some specimens, I give the following labels of specimens in the Melbourne Herbarium seen by Mueller, which have been sent to me by Professor Ewart. I have excluded those specimens of *E. Dawsoni* and *E. Baueriana* which Mueller attributed to *E. polyanthemos*. The labels of these specimens are, in some cases, referred to at p. 113, sometimes with some change in the verbiage. In most cases the leaves are orbicular to broad- or oblong-lanceolate.

Victoria (seen by Mueller).

McAllister River (Mueller, 1858). Seen by Bentham.

"Hill Box, Red Wood," Mt. Kosciusko Range (Find'ay, January, 1880). Wangaratta. Also timber No. B2, from same locality.

Beechworth and near Chiltern (A. W. Howitt). Ovens River (Mueller, January, 1853). Seen by Bentham.

Bindi (?). Gippsland (Mr. O'Rourke, A. W. Howitt).

Heyfield and Euroa (A. W. Howitt).

Upper Avoca and Loddon Rivers (A. C. Purdie, 1894).

With lanceolate leaves, Ravenswood (Walter K. Bissill).

Red Box. Wood red, close-grained, durable and very useful. Warrandyte, July, 1874 (? Walter).

"Walter's timber specimen from Anderson's Creek."

New South Wales (seen by Mueller).

Delegate district (W. Baeuerlen, March, 1885, No. 124). Flowering as a shrub about 8 or 10 feet high, very spreading. Occurring only once on a hill here. Quiedong, near Bombala (W. Baeuerlen, March, 1887, No. 419). Bark light or yellow-grey, fibrous, persistent except on the topmost smallest branchlets. Trunk 2–3 feet, low, soon dividing. Branches wide-spreading. 50–60 feet high (do. No. 418).

"White Box. Upright tree 50–70 feet high. 2–3 feet diameter. Common in Lachlan and Murrumbidgee districts." (J. Duff, 1883, No. 44.)

New South Wales.

Following are some additional specimens in the National Herbarium, Sydney:—

"Small to medium-sized trees up to 40 or 50 feet. Bark ribbony or coming away in flakes, leaving a mottled patchy stem of red and grey. Foliage varying in size and shape; a most variable tree. Timber spoken of locally as first-class, but seldom reaches mill-size in the district." Wyndham (J. L. Boorman).

"Has a persistent, rather rough bark; spreading and rarely tall. Locally called 'Black Box' (?) near Bega." (W. D. Francis).

"Bark fibrous, persistent up to the branches, then whitish. About 50 feet high. Flowers creamy white, buds ashy." Albury (Rev., now Bishop J. W. Dwyer, No. 111). Albury (A. V. Frauenfelder).

Gundaroo (Rev. J. W. Dwyer). Mt. Stromlo, Federal Territory (C. J. Weston). With cylindroid fruits and lanceolate leaves. Malcolmvale, Majura, Federal Territory (C. J. Weston, No. 48). Smooth bark, almost to ground; some of the leaves lanceolate. Towards Murrumbidgee from Canberra (R. H. Cambage, No. 2974).

Very common throughout the district and known as "Red Box." It occasionally produces a straight, workable timber, which is said to be excellent for all purposes, but usually it is a small much-branched tree. It suckers freely, and is a good honey plant. Trunkey (J. L. Boorman).

"Red Box; gum bark, except at base." With lanceolate leaves, Hill End (R. H. Cambage, No. 2751).

Bumbery (J. L. Boorman).

"Rather low, well-branched trees. The bark white or greyish. Timber chiefly used for fencing, height 40–50 feet, girth 3 to 4 feet." Box from the ranges, Mount Esk, Bowan Park, near Cudal (W. F. Blakely).

AFFINITIES.

These are dealt with at p. 116 of Part XIII, and it is only necessary to add *E. Dawsoni* to the species there enumerated. The differences between *E. polyanthemos* and this species are dealt with at p. 57 of the present Part.

DESCRIPTION.

LXIV. E. Baueriana Schauer.

FIGURED and described at p. 120, Plate 59, Part XIII, of this work. See also p. 149, Plate 215, Part LVII of my "Forest Flora of New South Wales."

RANGE.

The following specimens from the Melbourne Herbarium have been lent to me by Professor Ewart. They were all labelled *E. polyanthemos* by Mueller and are very interesting on that account, since they help to interpret his own and Bentham's writings on that species. They usefully supplement the list of localities given at pages 122–3 of Part XIII of the present work.

VICTORIA (SEEN BY MUELLER).

Australia Felix (J. Dallachy, 1852).

"Beyond Mount Disappointment" with narrow- to broad-lanceolate leaves (Mueller); about Station Peak (Mueller; both early fifties).

Lake Wellington, Lake Tyers, Mitchell's River and Tambo. (Mueller.)

Upper Genoa River; Rhytiphloiæ (Mueller, September, 1860).

NEW SOUTH WALES (SEEN BY MUELLER).

1. "Poplar leaf Box," Round leaf or Poplar Box. No attributes of "Gum" about it. Very ornamental. Hard to kill. Flowers most abundant. Rich in honey. Candelo, damp gullies and river banks near the sea.

2. Bark rugose, reticulately wrinkled, dull olive green or ash grey, smaller branches smooth, green. Parrel 20–40 feet. Diameter 18 inches–3 feet. Murrah River to Towamba, along the coast, and a path at Wolumla Camping Reserve. (Both 1 and 2, Tyrone White, 1885.)

"Round-leaved Box, Ulladulla (J. S. Allan, No. 8B).

(The above are South Coast.)

"Bark slightly furrowed and grey. Spreading tree 40 feet high, stem 2 feet diameter. Liverpool (John Duff).

The following were collected by Rev. Dr. Woolls, and the labels bear some of his remarks, which explain some of his writings :—

1. " Hemiphloiæ. Bastard Box. Very like the ' true Box' in appearance (*E. hemiphloia*). May be *E. populnea* or *E.* (*c*) *gneorifolia*." This specimen was labelled *E. polyanthemos* by both Mueller and Bentham. Fairfield. (*E. populnea* is a synonym of *E. populifolia*. See Part X, p. 340.)

2. " Poplar-leaved Gum. Rhytiphloiæ. Bark persistent. Small tree on the Nepean called Lignum Vitæ. Heart wood very hard. *E. populnea* ? See Hooker." Labelled *E. polyanthema* Schauer by Mueller, and Bentham concurred.

3. " *E. populnea*. On the banks of the Nepean. Bark like Stringybark, but not so fibrous. Sometimes called Bastard Box. I think this must be *E. populnea*. Wood very hard, used for rough furniture. Small tree called Lignum Vitæ."

Following are specimens additional to those seen by Mueller or recorded by myself, *op. cit.* :—

Southern New South Wales.—" Small trees or large shrubs, leafy from the ground upwards. Locally known as Bastard Box." Eden-Towamba (J. L. Boorman). " Blue Box," near Cobargo (W. Dunn). Moruya (E. Breakwell).

" Exceedingly large trees, having large and round stems, of a Box-like scaly appearance. Yield a large amount of good, sound timber for use in fencing and such-like purposes. Has yielded most of the fencing on the Bodalla Estate. Fairly common. Nerrigundah (J. L. Boorman).

Cobbitty, near Camden, on the river Nepean banks (J.H.M.).

Northern New South Wales.—Enmore, 18 miles east of Uralla, head waters of the Macleay River. " On Silurian (?) slate formation, 3,300 feet above sea level. Greatest elevation known to me for this species." (R. H. Cambage.)

DESCRIPTION.

CCXXXV. E. conica Deane and Maiden.

In *Proc. Linn. Soc. N.S.W.*, xxiv, 612 (1899), with a Plate.

The description will be found at p. 123, Part XIII, of the present work, and figures at Plate 60. It is also figured at Plate 219, Part LVIII of my "Forest Flora of New South Wales."

SYNONYM.

E. Baueriana Schauer var. *conica* Maiden, in this work, p. 123, Part XIII.

In certain cases (of which this is one), it is a matter of honest opinion as to whether a plant may be looked upon as a variety of a certain species or not. It is a geminate species with *E. Baueriana*, and I think that convenience will be better served by looking upon *E. conica* as distinct.

RANGE.

It is confined to New South Wales and Queensland so far as we know, and many localities are cited at p. 124, Part XIII of the present work. The following are additional :—

New South Wales.

"Large fuzzy Box-trees, 40-60 feet. It grows in a low moist place, subject to occasional floods." Yalgogrin (J. L. Boorman).

"A White Box. Has a rough white bark almost to tips of limbs; practically no bole; of a spreading and gnarled appearance, and useless." Cumbijowa State Forest, 12 miles east of Forbes (Forest Guard K. Walker).

"Like Peppermint, 24 inches diameter, 30 feet high. Rough grey bark, clean at tips of branches; growing on high country." (Harvey Range State Forest.)

" Yamble Box." Near Yamble, *via* Mudgee (A. Murphy).

Near Tingha (Gordon Burrow; I have not specimens, but do not dispute the record).

" White Peppermint. A huge tree, in appearance like *E. Stuartiana*; a rough white bark. Parish Nangarah, County Darling, near Barraba (W. A. W. de Beuzeville).

" Fairly large tree, branches somewhat pendulous. Rough and fibrous bark on trunk and large branches, clean upper branches. Growing on alluvial flats at Arrarownie, head of Bohena Creek, Pilliga Scrub, 35 miles south of Narrabri (Forest Guard T. W. Taylor, No. 82). " A White Box, rather smooth white bark." Baradine and Bohena Creeks, Pilliga Scrub (W. A. W. de Beuzeville). " Bastard Box," Baradine district (Dr. H. I. Jensen, No. 75). " Box, rough bark to top. 40 feet high, 40 inches in girth." Parish Bomera, County Pottinger (Forest Guard M. H. Simon). " Narrow blue-leaf Box. 60 feet high, branching low." Pilliga (E. H. F. Swain); Pilliga Forest (Gordon Burrow).

QUEENSLAND.

Stanthorpe (J. L. Boorman); Warwick (Dr. J. Shirley); " Box," Gowrie, Little Plain (W. F. Gray).

LXX. E. concolor Schauer.

The Type. The *concolor* confusion.

The type of this species comes from limestone hills near Fremantle, Western Australia, as stated at p. 153, Part XIV of this work. A good deal of confusion has gathered around it, partly because the incomplete material available could not be interpreted at the time.

Bentham (B.Fl. iii, 249) quotes, in addition to the type, only specimens which come from the south coast, hundreds of miles from the type locality.

In *Proc. Roy. Soc. N.S.W.*, xlvii, 231 (1913), I have drawn attention to two specimens of the type lent to me by Dr. Fischer von Waldheim, then of the St. Petersburg Herbarium. Careful drawings were made of the specimens before returning them, but one was in leaf only and the other was in flower, but without opercula. With additional experience gained since then, and comparison of all material obtained from the Fremantle district (including Claremont), I find that figures 7 *a-d*, Plate 63, are practically identical with the type of *E. concolor*.

Fremantle material has, by Bentham, local botanists and myself, been included in three species in all, viz., *E. decipiens*, *uncinata*, and *falcata*. Following are references which will help to elucidate this :—

1. Under *E. decipiens* Endl. See Part XIV, last paragraph of p. 151, also Plate 63, figs. 7 *a-d*. Near Claremont Asylum, Perth, " practically a type locality of *E. concolor*." In other words, I figured practically a typical specimen of *E. concolor* as *E. decipiens*.

Mr. W. V. Fitzgerald, a well-informed Western Australian botanist, wrote, " *E. decipiens* Endl. The Fremantle form consists of small thickets of erect shrubs, 8–12 feet high, growing on tertiary limestone."

Bentham (B.Fl. iii) kept *E. decipiens* and *E. concolor* very far apart in his classification. Both under *E. decipiens* (p. 218) and under *E. concolor* (p. 247) he recognises shrubby and tree forms, but although he gives a far larger ultimate size to the former, he, speaking of the latter, says, " larger and more rigid (than *E. decipiens*) in all its parts." To what extent the shrubby and tree forms are to be divided amongst *E. decipiens* and *E. concolor* begs the question as to whether the two species are really different.

In *Proc. Roy. Soc. N.S.W.*, xlvii, 231 (1913) I express the opinion that *E. decipiens* and *E. concolor* are not specifically different, in which case *E. decipiens*, being the older name, would stand. In view of the fact that inquiry is still

proceeding as to the relations of shrubs and trees from, say, the Swan River to King George's Sound, hitherto variously attributed to *E. concolor* and to *E. decipiens*, the matter may well stand over for a reasonable time.

It may turn out that—

(*a*) *E. concolor* is the Fremantle form of *E. decipiens.*

(*b*) *E. decipiens* var. *angustifolia* (see Part XIV, p. 149) is an even narrower-leaved form of *E. decipiens* than is typical *E. concolor.*

2. Under *E. uncinata* Turcz. See Part XIV, and at p. 145 we have Subiaco Beach near Fremantle (Dr. J. B. Cleland) and 3 miles south of Fremantle (W. V. Fitzgerald). I have also received specimens from "near Fremantle, Limestone" (C. Andrews). Not only did Mr. Fitzgerald, but also Mr. Andrews, another competent botanist, label them *E. uncinata.* They had not seen the type of *E. uncinata*, the forms of which have not even yet been fully worked out, and it is useful to point out that the view above indicated was held near the type locality of *E. concolor* itself.

It will be seen that Bentham (B.Fl. iii, 218) points out the similarity of the fruit in *E. decipiens* and *E. uncinata.*

3. Under *E. falcata* Turcz. var. *ecostata* Maiden. See Part XV, p. 181. On limestone, near Fremantle. (Cecil Andrews and W. V. Fitzgerald). These specimens are discussed in their relations to *E. concolor* lower down the page and on page 182. Placing these Fremantle specimens under *E. falcata* is an act for which I am alone responsible, but the Fremantle plant has the buds sometimes so ribbed as to resemble *E. falcata* somewhat.

Drummond's No. 77 is not *E. concolor.*

Bentham's citation of Drummond's 4th Coll. No. 77 under *E. concolor*, a very thick-leaved specimen, only seen in mature leaf and fruit, and figured at fig. 11, Plate 63 (Part XIV) is important inasmuch as it was the only specimen, named *E. concolor* by high authority, which was available for the guidance of Australian botanists for very many years. At fig. 12 I have matched Dr. Diels' Cape Riche specimen with it, and still think that this view is probably correct.

I have referred at length to Dr. Diels' specimens at p. 155, Part XIV. Some further collecting is required, in connection with the general *decipiens-concolor* investigation already referred to, when the position of these specimens can again be referred to, but at present it can be said that none of them are typical for *E. concolor*, and I have made a slip of the pen in the lettering under fig. 11 (page 163) in saying that Drummond's specimen is typical for *E. concolor.*

AFFINITIES.

At pages 66 and 67 I have already gone into the relations of *E. concolor* to *E. decipiens*, *E. uncinata* and *E. falcata*, and I have little to add.

1. With *E. decipiens* Endl.

Dr. Stoward, under No. 122, sent me a specimen of " White Gum, height 30–40, diameter of trunk 15–18 inches. Grows on limestone country in the Tuart belt along the coast. Spot near Newmarket Hotel, Coogee Road. April-May, 1917." This is from the neighbourhood of typical *E. concolor*, and although these specimens lack juvenile leaves, they seem to answer to the description of *E. decipiens*. If *E. concolor*, as I surmise, then the tree is the largest recorded for that species.

2. With *E. uncinata* Turcz.

For this species I would invite attention to Plate 62, Part XIV, and would say that the species is, as regards some of the Western Australian specimens, under revision.

3. With *E. falcata* Turcz. var. *ecostata* Maiden.

For this species see Plate 68, Part XV.

Explanation of Plates (172–5).

PLATE 172.

E. eximia Schauer.

1*a*. Peltate juvenile leaf, with curved venation; 1*b*, peltate juvenile leaf, the venation advanced a stage towards the pinnate; 1*c*, intermediate leaf, the venation still further advanced, but not yet completely pinnate, as the mature leaf depicted at fig. 1, Plate 173. Glenbrook, Blue Mountains, N.S.W. (J.H.M.)

2. Broad, short, intermediate leaf, not in the juvenile stage. Note the glandular appearance of the young shoots. Springwood, Blue Mountains. (J. L. Boorman.)

3*a*. Elongated petiolate juvenile leaf; 3*b*, 3*c*, 3*d*, different shapes and sizes of juvenile leaves, all with auriculate bases. 3*d* is almost hastate in shape. The secondary veins of 3*c* and 3*d* at a smaller angle to the midrib than those of 3*a* and 3*b*. These specimens are accompanied, at the lower parts of the branchlets, by small, early leaves, arrested in their growth, similar in shape, and only differing from the other leaves in size. These remarks apply to other species also. Hornsby Valley, Galston Road, Sydney district. (W. F. Blakely.)

4. Buds showing shrinking of the calyx-tube in drying and thus the operculum takes on a mushroom shape. Cultivated plant, Inner Domain, Sydney. (J.H.M.)

Compare *E. Watsóniana*, fig. 1*b*, Plate 174.

PLATE 172—*continued.*

E. eximia Schauer—*continued.*

5. Buds, with ridges on calyx-tube. Grose River, N.S.W. (George Caley, September, 1801.) (From the British Museum.)

6*a*. Buds with the ordinary conical opercula; 6*b*, buds with opercula almost hemispherical; 6*c*, back and front views of anther. Berowra to Peat's Ferry, Hawkesbury River. (J.H.M. October, 1895.)

7. Fruits, scarcely urceolate in shape. Woy Woy, Hawkesbury River. (A. Murphy.)

8. Fruits unusually urceolate in shape. Badgery's Crossing to Nowra, Shoalhaven River. (W. Forsyth and A. A. Hamilton.) From same tree as fig. 1, Plate 173.

PLATE 173.

E. eximia Schauer. (See also Plate 172.)

1 Rather long, mature leaf. Badgery's Crossing to Nowra, Shoalhaven River, N.S.W. (W. Forsyth and A. A. Hamilton.)

E. peltata Benth.

2*a*. Juvenile leaf, nearly orbicular, peltate; 2*b*, juvenile leaf, a stage further advanced, broadly lanceolate, peltate, venation making a smaller angle with the midrib; 2*c*, mature leaf, of the ordinary lanceolate shape (Mueller never saw mature leaves of his own species,—see "Eucalyptographia" plate); 2*d*, umbel of young buds, with bracteoles still attached; 2*e*, buds; 2*f*, buds, further advanced, and with conoid operculum; 2*g*, front and back views of anther. Alma-den, Northern Queensland. (R. H. Cambage, No. 3884.)

E. Watsoniana F.v.M. (See also Plate 174.)

3*a*. Portion of mature leaf; 3*b*, bud; 3*c*, front and back views of anthers; 3*d*, fruit. Wigton Creek. Queensland. (T. Wentworth Watson.) From a portion of the type in the Melbourne Herbarium, Note that the bud is more wrinkled than that collected from a cultivated tree in the Botanic Gardens, Sydney (see figs. 5*a*, Plate 173, and 1, Plate 174.)

4. A comparatively long, narrow, mature leaf with long petiole. Parish of Boondooma, Queensland. (S. J. Higgins, through C. T. White.)

5. Buds; note their nearly flat tops, and absence of wrinkles; 5*b*, youngish fruit, also free from wrinkles; drawn from fresh specimens in the Botanic Gardens, Sydney, raised from a seed obtained from the type.

PLATE 174.

E. Watsoniana F.v.M. (See also Plate 173.)

1*a*. Mature leaf; 1*b*, buds. This shrinking of the calyx-tube and ribbing, owing to the vascular bundles standing out, together with the "overhanging" appearance of the operculum, is seen also in *E. eximia* (fig. 4, Plate 172), and in some other species. It is the effect of drying. Cultivated in Botanic Gardens, Sydney.

E. trachyphloia F.v.M.

2*a*. Small juvenile leaf, peltate; 2*b*, juvenile leaf, a stage further advanced; 2*c*, fruits. Arrarownie, Borah Creek, Pilliga Scrub, N.S.W. (H. I. Jensen, No. 152.)

3. Mature leaf. Pilliga Scrub. (E. H. F. Swain.)

4. Narrow mature leaf. Coolabah, N.S.W. (W. W. Froggatt.)

5. Intermediate or nearly mature leaf. South Queensland. (Forest Inspector J. Board.)

PLATE 174—*continued.*

E. trachyphloia F.v.M.—*continued.*

6*a*, 6*b*, Juvenile leaves, not in the earliest stage; 6*c*, mature leaf; 6*d*, twig with buds; 6*e*, front and back views of anther; 6*f*, fruits. Bundaberg, Queensland. (J.H.M.) N.B.—This is the type locality of the species.

7*a*. Juvenile leaf in an early, though not the earliest stage; 7*b*, the same, but a little further advanced. Note the glandular hairs round the edges of these two leaves. 7*c*, intermediate leaf; 7*d*, fruits. N.B.—The mature leaves from Bathurst Island are so similar to that of fig. 3 of the present plate that they have not been depicted. Bathurst Island, Northern Territory. (G. F. Hill No. 465.) It is to be observed that the Bathurst Island foliage in its younger stages is coarser than any that has so far been recorded from the mainland.

PLATE 175.

E. hybrida Maiden.

1*a*. Mature leaf (juvenile leaf not available); 1*b*, buds; 1*c*, views of two anthers; 1*d*, 1*e*, fruits in two stages, *i.e.*, the less advanced showing a rim. Concord, near Sydney. (R. H. Cambage, J. L. Boorman, J.H.M.) The type.

2*a*, 2*b*, Mature leaves; 2*c*, buds; 2*d*, views of two anthers. Milson Island, Hawkesbury River. (Dr. J. B. Cleland.)

E. Kruseana F.v.M.

3*a*. Twig bearing fruits; 3*b*, different views of anthers; 3*c*, flowers; 3*d*, a solitary bud (all on the specimen) and a fruit. 100 miles north of Israelite Bay, W.A. (J. D. Batt.) The type.

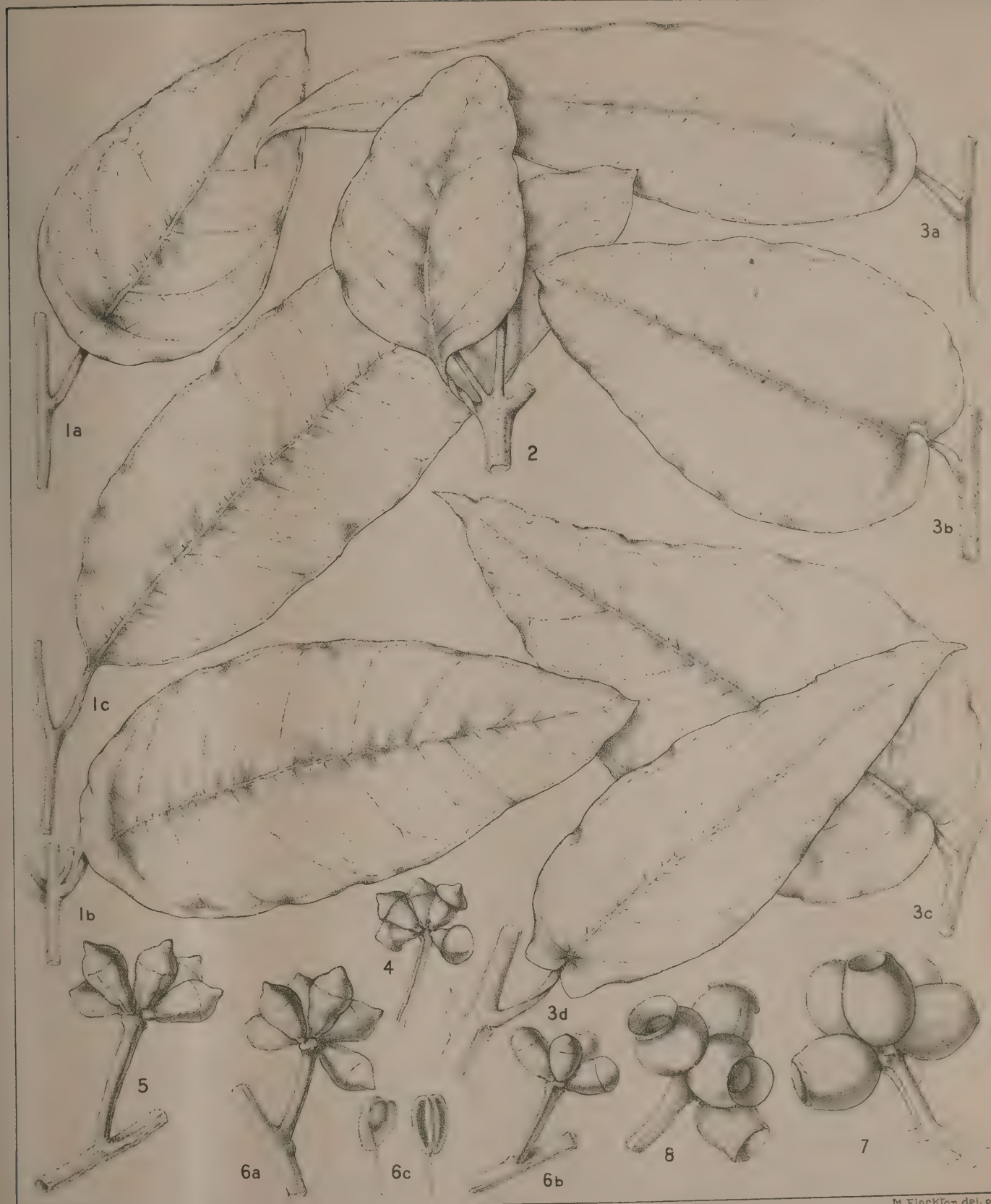
4*a*. A leafy shoot, some of the leaves younger than those depicted at 3*a*; 4*b*, buds; 4*c*, fruits. 50–100 miles east of Kalgoorlie (Transcontinental Railway Survey), W.A. (Henry Deane.) Type of *E. Morrisoni* Maiden.

E. Dawsoni R. T. Baker.

5. Buds of the type as depicted in Vol. XXIV, Plate XXI, *Proc. Linn. Soc. N.S.W.*

6*a*. Juvenile leaf; 6*b*, three views of anthers; 8*a*, fruits; 8*b*, the same, end on. Denman, N.S.W. (R. H. Cambage No. 2711.)

7*a*. A flower; 7*b*, the deciduous collar or staminal ring referred to at p. 57. Cobborah, N.S.W. (District Forester Marriott.)



EUCALYPTUS EXIMIA SCHAUER. [See also Plate 173.]

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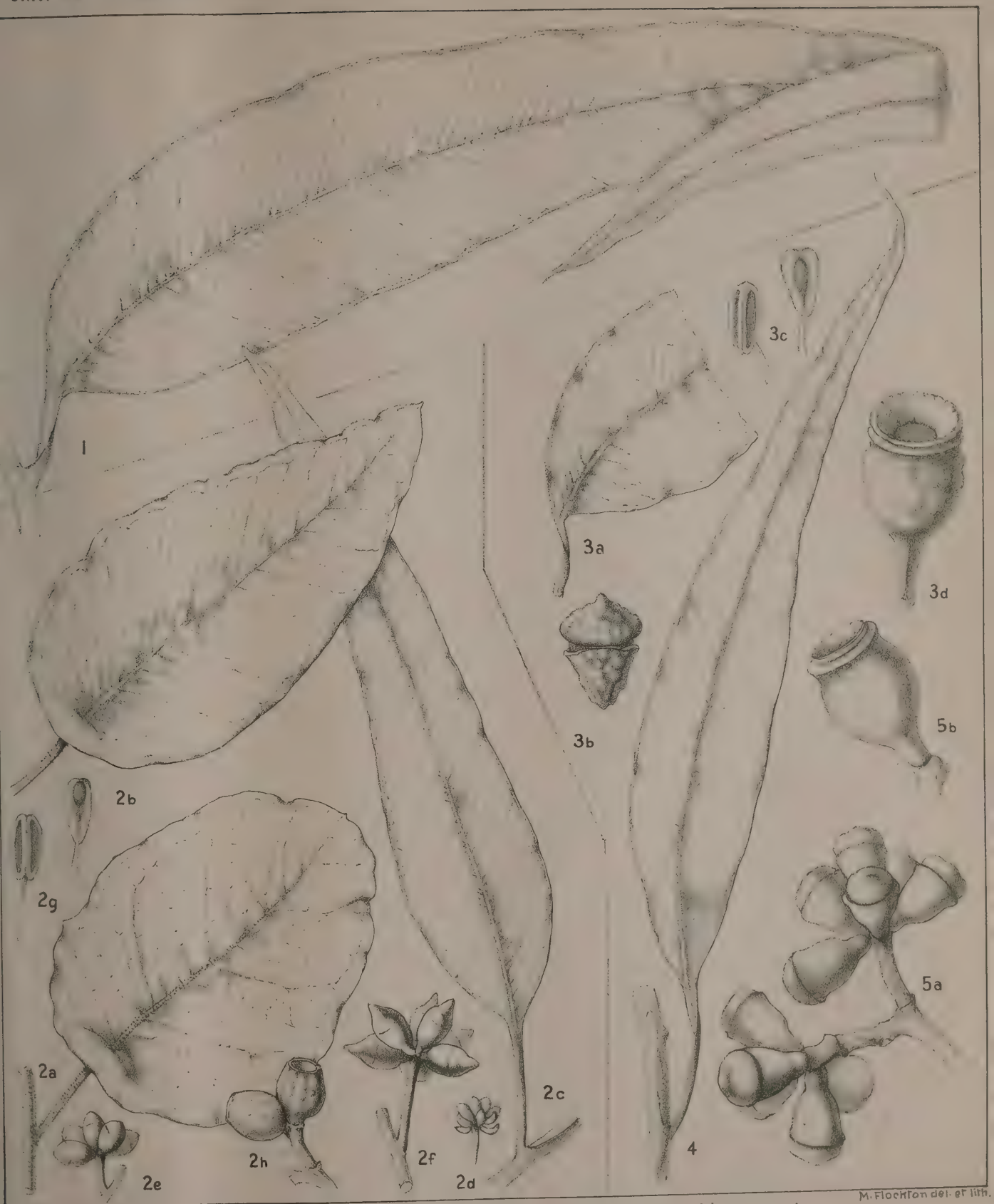

EUCALYPTUS EXIMIA SCHAUER. (*1*) [See also Plate 172.]

E. PELTATA F.v.M. (*2*)

E. WATSONIANA F.v.M. (*3–5*) [See also Plate 174.]

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EUCALYPTUS WATSONIANA F.v.M. (*1*) [See also Plate 173.]

E. TRACHYPHLOIA F.v.M. (*2–7*)

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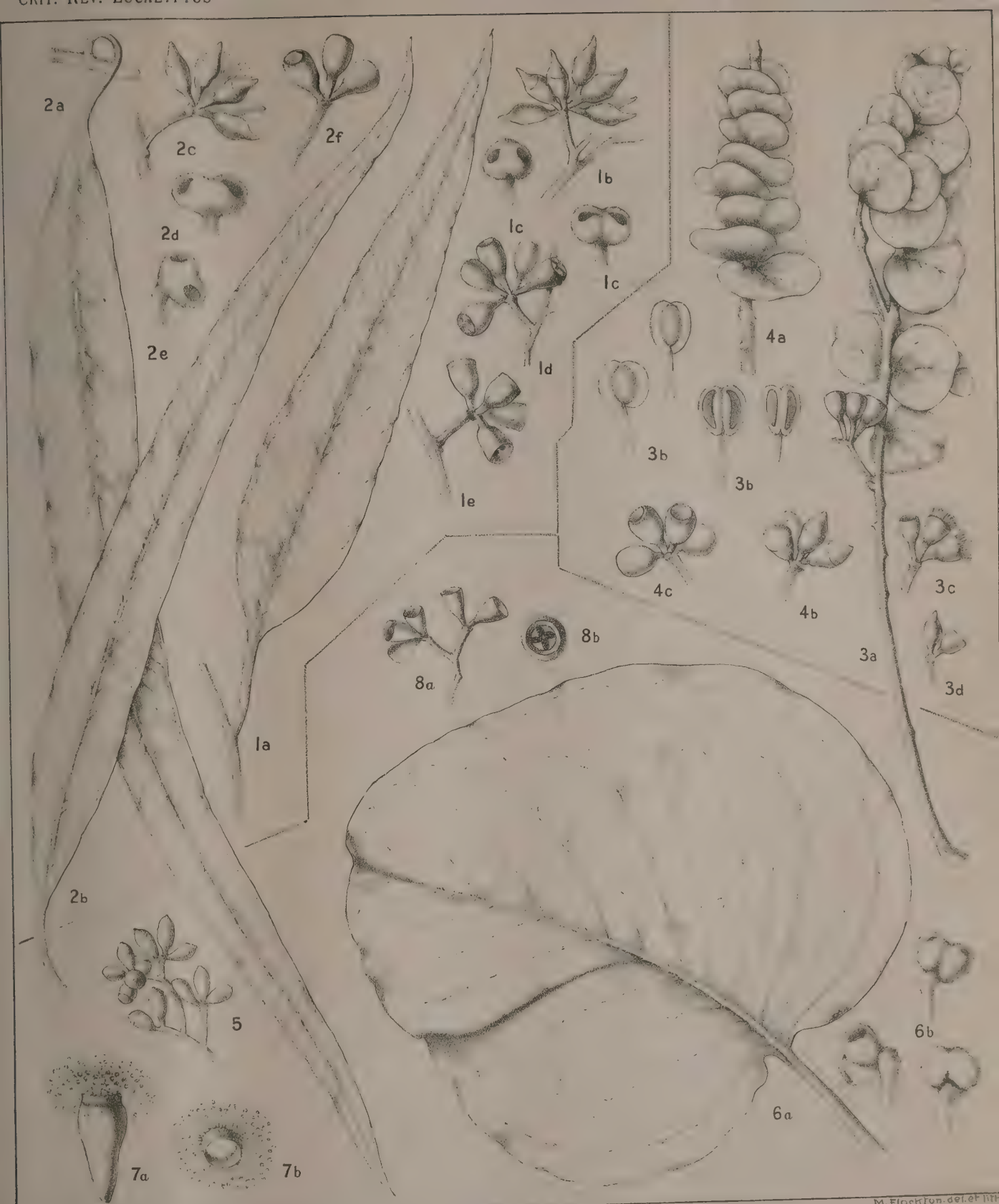

EUCALYPTUS HYBRIDA MAIDEN. (*1, 2*)

E. KRUSEANA F.v.M. (*3, 4*)

E. DAWSONI R. T. BAKER. (*5–8*) [See also Plate 58, figs. 4, 9–11.]

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The following species of Eucalyptus are illustrated in my "Forest Flora of New South Wales"* with larger twigs than is possible in the present work; photographs of the trees are also introduced wherever possible. Details in regard to their economic value, &c., are given at length in that work, which is a popular one. The number of the Part of the Forest Flora is given in brackets :—

acacioides A. Cunn. (xlviii).
acmenioides Schauer (xxxii).
affinis Deane and Maiden (lvi).
amygdalina Labill. (xvi).
Andrewsi Maiden (xxi).
Baileyana F.v.M. (xxxv).
Baueriana Schauer (lvii).
Baueriana Schauer var. *conica* Maiden (lviii).
Behriana F.v.M. (xlvi).
bicolor A. Cunn. (xliv).
Boormani Deane and Maiden (xlv).
Bosistoana F.v.M. (xliii).
Caleyi Maiden (lv).
capitellata Sm. (xxviii).
Considenіana Maiden (xxxvi).
coriacea A. Cunn. (xv).
corymbosa Sm. (xii).
crebra F.v.M. (liii).
dives Schauer (xix).
fruticetorum F.v.M. (xlii).
gigantea Hook. f. (li).
goniocalyx F.v.M. (v).
hæmastoma Sm. (xxxvii).
hemiphloia F.v.M. (vi).
longifolia Link and Otto (ii).
Luehmanniana F.v.M. (xxvi) (=*E. virgata*).
macrorrhyncha F.v.M. (xxvii).
maculata Hook. (vii).
melanophloia F.v.M. (liv).
melliodora A. Cunn. (ix).
microcorys F.v.M. (xxxviii).
microtheca F.v.M. (lii).
numerosa Maiden (xvii).
obliqua L'Hérit. (xxii).
ochrophloia F.v.M. (l).
odorata Behr and Schlechtendal (xli).
oleosa F.v.M. (lx).
paniculata Sm. (viii).
pilularis Sm. (xxxi).
piperita Sm. (xxxiii).
Planchoniana F.v.M. (xxiv).
polyanthemos Schauer (lix).
populifolia Hook. (xlvii).
propinqua Deane and Maiden (lxi).
punctata DC. (x).
regnans F.v.M. (xviii).
resinifera Sm. (iii).
rostrata Schlecht. (lxii).
rubida Deane and Maiden (lxiii).
saligna Sm. (iv).
siderophloia Benth. (xxxix).
sideroxylon A. Cunn. (xiii).
Sieberiana F.v.M. (xxxiv).
stellulata Sieb. (xiv).
tereticornis Sm. (xi).
virgata Sieb. (xxv).
vitrea R. T. Baker (xxiii).

* Government Printer, Sydney. 4to. Price 1s. per part (10s. per 12 parts); each part containing 4 plates and other illustrations.

Sydney: William Applegate Gullick, Government Printer.—1920.

A Critical Revision of the genus Eucalyptus

BY

J. H. MAIDEN, I.S.O., F.R.S., F.L.S.

(Government Botanist of New South Wales and Director of the Botanic Gardens, Sydney).

Vol. V. Part 3.

Part XLIII of the Complete Work.

(WITH FOUR PLATES.)

"Ages are spent in collecting materials, ages more in separating and combining them. Even when a system has been formed, there is still something to add, to alter, or to reject. Every generation enjoys the use of a vast hoard bequeathed to it by antiquity, and transmits that hoard, augmented by fresh acquisitions, to future ages. In these pursuits, therefore, the first speculators lie under great disadvantages, and even when they fail, are entitled to praise."

MACAULAY'S "ESSAY ON MILTON."

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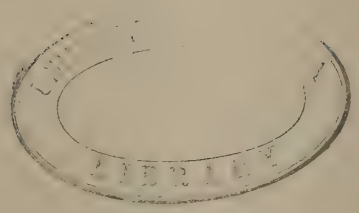

CCXXXVI. Eucalyptus ficifolia F.v.M.

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DESCRIPTION.

CCXXXVI. E. ficifolia F.v.M.

In *Fragmenta* ii, 85 (1860).

Following is a translation of the original :—

Leaves moderately petiolate, opposite, ovate-lanceolate or sub-ovate, acute, coriaceous, spreadingly and very finely penniveined in a crowded manner, scarcely pellucid-punctate, straightly and faintly reticulate-veined, paler on the underside, peripheral vein close to the margin, *umbels* terminal and paniculate, *pedicels* quadrangular, about the same length as the calyx-tube, *fruits* large, truncate- or suburceolate-ovate, exangular, three- or four-celled, valves deltoid, deeply included and deflexed, *fertile seeds* greyish brown with long wings in the fore part, most of the seeds sterile, narrow and elongated.

Bentham (B.Fl. iii, 256), had his doubts as to its specific rank, and dismissed it in the following words :—

E. ficifolia, F. Muell. *Fragm.* ii, 85. Only known from imperfect specimens in fruit, which differ in no respect from *E. calophylla*, except that the seeds are of a pale colour and the testa expanded at one end, or round one side into a broad, variously-shaped wing. Further specimens may prove these differences not to be constant.

West Australia. Broke's Inlet, " Black-butt," *Maxwell*. From the Hay, Gordon and Tone Rivers in the same neighbourhood are flowering specimens undistinguishable from *E. calophylla*, which may possibly belong to this species.

It was then more fully described, and also illustrated, by Mueller in the " Eucalyptographia." Some of his remarks on the colour of the filaments are referred to below.

SUPPOSED VARIETY.

E. ficifolia F.v.M. var. *Guilfoylei* Bailey, in *Proc. Roy. Soc. Q.*, x, p. 17 (1894).

This is identical with *E. calophylla* R.Br. var. *rosea* (Hort.) Maiden, see below, p. 75.

RANGE.

The type came from Broken Inlet, " near the coast of the estuary, Broken Inlet, south West Australia," *Maxwell*. I would suggest that this is a slip of the pen or a limited local name for Brookes' Inlet, between Irwin Inlet and D'Entrecasteaux Point (*i.e.*, approaching Cape Leeuwin).

Bentham says "from the Hay, Gordon and Tone Rivers in the same neighbourhood are flowering specimens undistinguishable from *E. calophylla*, which may possibly belong to this species." It may be said that dried flowering specimens of *E. ficifolia* and *E. calophylla* may be difficult to discriminate from each other.

Mueller ("Eucalyptographia") says: "From the western side of Irwin's Inlet to the entrance of the Shannon, constituting a distinct forest belt in the coast region, though not actually approaching the sea-shore."

Brookes's Inlet appears to be the most westerly locality, and it extends easterly to the west side of Irwin's Inlet and the Shannon River to Irwin's Inlet, and northerly to near Mount Hoskins in the Frankland district. The range of this species, which is not very great, has not yet been definitely ascertained. It is so extensively cultivated in gardens that one has to be on one's guard in recording localities for it, particularly west and north of King George's Sound.

Dr. R. H. Pulleine, of Adelaide, who made an extensive trip, found it "beautifully in flower in December, 1917." He found it on coastal hills (some of them hundreds of feet high), between Landers' Camp, about 15 miles north-north-west of Nornalup. It forms flat-topped impenetrable thickets, 8–10 feet high, often so thick and intertwined that you could walk over the top, rather than get through it. He referred me to Mr. Brockman, who obligingly replied as follows :—

"Only found in its wild state along the south coast in small areas extending from Denmark to the Nornalup Inlet, a distance of about 35 miles by roughly 5 miles. There is no large extent of it in this area, and I think about 2,000 acres is about the largest area where it grows, scattered and in stunted trees. There are a few clumps of flat-topped thickets mixed with other varieties of Gums. The largest tree, judging from memory, was about 6 feet (*sic*) diameter and about 35 feet, with a ragged and spreading top." (E. J. T. Brockman, Reviley *via* Balingup.)

It is in the National Herbarium of New South Wales from the following localities :—

"Trees of 12, 14 and 20 feet," west side of Irwin's Inlet (Sid. W. Jackson, through H. L. White).

"Red-flowering Gum. Height up to 30 feet and up to 3 feet in diameter. Grows on sandy hills near Irwin Inlet and on granite hills near Mt. Hoskins in the Franklin district." (Dr. F. Stoward, No. 112).

Shannon River; also near Wilson's Inlet (W. V. Fitzgerald).

AFFINITY.

With *E. calophylla* R.Br. See p. 78.

DESCRIPTION.

CCXXXVII. E. calophylla R.Br.

In *Journ. Geog. Soc.* i, 1831 (1832), 20; Lindley in *Bot. Reg.* (1841), Pl. Misc. 72.

In the "General view of the botany of Swan River," by Robert Brown (*Journ. Roy. Geog. Soc.* i, 17–21, 1832), at pp. 19–20, we have :—

Of Eucalyptus, the only species in the collection (Fraser's) had been first found on Captain Flinders' voyage at King George's Sound, on the shore of which it was the only useful timber tree, though there of very moderate size. I have named it *Eucalyptus calophylla*.

Lindley's description was as follows :—

Foliis alternis ovato-lanceolatis marginatis parce punctatis nunc acuminatis nunc obtusis cum mucrone; venis primariis simplicibus pennatim dispositis contiguis subparallelis, umbellis terminalibus et axillaribus 4–5 floris, pedunculatis, operculo minimo hemisphaerico umbonato hinc cupulae c. cardine affixo.

(Of which the following is a translation :—Leaves alternate, ovate-lanceolate, marginate, with a few dots, sometimes acuminate, sometimes obtuse, with a mucro. Primary veins simple, pinnate, close together, sub-parallel, umbels terminal and axillary, 4–5 flowered, pedunculate, operculum very small, hemispherical, umbonate, fixed to the calyx-tube by a hinge.)

Lindley then proceeds in English :—

The name of *E. calophylla* is current in gardens for this beautiful plant, but I cannot discover it in books. It is a native of Port Augusta* on the south-west coast of New Holland, whence its seeds were sent to Capt. Jas. Mangles, R.N., by Mrs. Molloy, a lady enthusiastically fond of flowers, to whom we are indebted for many acquisitions. Its branches are of a rich reddish brown. The leaf-stalks, which are rather more than an inch long, are of the same colour. The leaves are from 4 to 6 inches long, ovate-lanceolate, flat, pale green, with a rich red marginal line, within which, at the distance of a quarter of a line, runs a faint intramarginal vein; when bruised they have a faint and rather pleasant smell; very few transparent dots are visible; the veins are delicate lines, almost at right angles to the midrib, from three-fourths to one and a half lines asunder, and running somewhat parallel till they lose themselves in the intramarginal vein; they are held together by fine reticulations. The whole appearance of the foliage is that of a *Calophyllum*. The flowers are large and white, the cup is obconical, 6 lines long, and as much across the mouth; the lid, however, is only half that diameter, and hangs to the edge of the cup on one side, by a narrow neck, so that it cannot fall off; this arises from the cup continuing to enlarge after the separation of the lid. (Lindley, *op. cit.*)

It is redescribed by Schauer in *Plantæ Preissianæ*, i, 131 (1844–5).

---

* This is not to be confused with Port Augusta, in South Australia. The home of the type of *E. calophylla* is now known as Augusta, and is just to the east of Cape Leeuwin.

Bentham (B.Fl. iii, 255) then described it as follows :—

A beautiful tree, with a more dense foliage than usual in the genus, the rough, corky bark coming off in irregular masses (*Oldfield*). *Leaves* ovate, ovate-lanceolate or lanceolate, obtuse or mucronate-acute, rather rigid with very numerous transverse parallel veins, the intramarginal one scarcely distant from the edge. *Umbels* loose, with rather large flowers, in a terminal corymbose panicle, with one or two sometimes in the upper axils. *Peduncles* flattened or nearly terete, pedicels longer than the calyx-tube. *Calyx-tube* turbinate and often ribbed on the adnate part, the free part much dilated, often ½ inch diameter. *Operculum* hemispherical, obtuse or umbonate, shorter than the calyx-tube and continuous with it till the flower expands. *Stamens* ½ to ¾ inch long; anthers ovate, with parallel distinct cells opening longitudinally. *Ovary* flat or slightly convex on the top. Fruit when perfect ovoid-urceolate, 2 inches long and above 1 inch diameter, very thick and hard, with a thick neck contracted at the orifice, but sometimes the fruit is smaller, the neck less distinct and less contracted. *Capsule* deeply sunk. *Seeds* large, ovate, black, flat or with a raised angle on one face, the edges acute but scarcely winged, the hilum large on the inner face.

It was figured and described by Mueller in his "Eucalyptographia."

Here we have a case of *nomen nudum* had the date been, say, thirty years later. Nowadays a date would not be accepted without a description, as was accepted by our predecessors in the case of 1831 or 1832. Probably Robert Brown distributed specimens to herbaria at this time, but the generally accepted dates of species in the old days were often in the nature of a compromise. Schauer in *Plantæ Preissianæ* 1, 131 (1845), attributes this species to Lindley, but Bentham, Mueller, and all other writers on Eucalyptus are unanimous in attributing it to Brown, and I do not agree that they are wrong. Lindley himself speaks of the name as "current" in his time.

This is the commonest "Red Gum" of Western Australia. The leaves slightly perfoliate in the young state. There is caoutchouc in the young leaves.

Miss Bussell, of Ellensbrook, informed me that Red Gum blossom is called "Booneet" by the blacks. They state that when it is in flower the Groper comes into the reef, so that the blacks can spear them. They make a somewhat similar observation in regard to the plant they call "Whale's Eye" (*Candollea cuneiformis* Labill).

In bark and general appearance the Red Gum resembles the Bloodwoods of the east. Red Gum is a pale-coloured timber with abundant gum-veins (in this respect also resembling Bloodwood). (It owes its common name to the abundance of its red astringent gum or kino.) I noticed fruit cases made with Jarrah ends and Red Gum sides. At a little distance the pale wood in a fruit case resembles Pine. (J.H.M. in *Journ. W.A. Nat. Hist. Soc.*, Vol. III, 1911).

When travelling in Western Australia a few years ago, this tree was reputed to flower every alternate year, and was said by some to yield the best honey.

Mr. A. H. Smith, of Baker's Hill, W.A., gave the following particulars in the *Western Mail* of 6th March, 1914, in regard to the flowering of this species. He is a beekeeper, and the notes would have increased value if they had been backed with the dates of the flowerings.

When well grown it is the largest of the trees in the coastal and hills districts. It blooms from February to April, March being the month of full bloom. Every year a few trees, particularly saplings, may be found in bloom, but usually only one year out of three is marked by abundant general blossoms. In other words, the majority of trees bloom one year and miss two. Sometimes only one year is missed,

sometimes it is three. Apparently the season and the bush fires have something to do with the blossoming. From a beekeeper's point of view the Red Gum honey harvest may be counted on once in three years. As the buds are formed only shortly before blossoming time, one canot tell whether the tree will bloom until December or maybe early in January.

This tree is occasionally planted by beekeepers, particularly in South Australia and Victoria, as a honey plant.

Schauer in *Plantæ Preissianæ* gives the aboriginal name as "N'gumbat." Captain J. Lort Stokes, in his "Discoveries in Australia," ii, 132, gave the aboriginal name as "Kardan." At Ellensbrook, in the south-west, the name, at least for the blossom, is "Booneet."

The following inspired paragraph in the *Western Mail* of 11th April, 1919, shows that an attempt is being made to change the vernacular name of Red Gum, so commonly applied in Western Australia to this tree, and replace it by "Marri," said to be of aboriginal origin. It remains to be seen if people will give up a name at the bidding of authority, however desirable the change may be.

Mr. Lane-Poole, the Conservator of Forests, is endeavouring to correct and replace the misleading name by which one of our most prominent timbers, the so-called Red Gum, is known. In the eastern States the term "Red Gum" is applied to *Eucalyptus rostrata*, the wood of which is red, hard, and somewhat resembles in appearance our Jarrah. The name of the tree evidently arose from the colour of the wood. Our Red Gum is *Eucalyptus calophylla*, and the name "Red Gum" was probably given to it on account of the quantity of red gum or kino which exudes from this tree. In some portions of the South-west, the natives, according to the writings of pioneers, called this tree "Kurden" or "Karden," while other tribes called it the "Marri" or "Maree." As the native name "Marri" is simple and in harmony with the native names karri, jarrah, and wandoo, Mr. Lane-Poole has decided to try and get people to adopt this name instead of the present common misleading one (*sic*) of Red Gum.

I have seen fowls eating the seeds, but do not know the result of lengthened indulgence in such a diet. The fruits, which are large, and of a suitable shape, have had a limited use in country districts as tobacco pipes, both in Australia and South Africa. During the Great War these fruits had a great vogue as protectors of steel knitting needles. Two fruits were connected with strips of elastic by ladies who knitted socks and other garments for our soldiers, and they were willing to pay fancy prices for these fruits and thus the Red Cross benefited.

VARIETY.

Var. *rosea* Maiden, in *Proc. Linn. Soc. N.S.W.*, xli, 187 (1916), a synonym of *E. ficifolia* F.v.M. var. *Guilfoylei* Bailey. As a matter of convenience this will be found under "Affinities" at p. 78 below, since it is not easy to make the subject clear without entering into an exhaustive comparison of *E. ficifolia* and *E. calophylla*.

SYNONYMS.

1. *E. splachnicarpa* Hook.

2. *E. glaucophylla* Hoffmansegg (perhaps)

1. In Hooker's *Bot. Mag.* t. 4036, is a figure of a twig in bud and flower, with immature fruit, sufficient, however, to distinguish the species. This is accompanied by a description in Latin, of which the following is a translation :—

Leaves alternate, oblique, ovate-lanceolate, with a marginal vein, penninerved, coriaceous, with terminal compound umbels, hemispherical operculum, sub-globose, broader than the calyx-tube. Fruit splachniform in shape.

Splachniform means that it resembles the fructification of a moss of the genus *Splachnum*. Sir William Hooker was a considerable authority on mosses.

2. *E. glaucophylla* Hoffmg.

The original, in a very rare work, is as follows :—

"(429) *Eucalyptus glaucophylla*. E. foliis superioribus sparsis petiolatis oblongis acuminatis apiculatis coriaceis glaucis, passim basi inaequalibus, nervis reticulantibus ante marginem connexis.

Hab. in Austral.

Caulis ramique teretia, cumque petiolis purpurascentia. Folia utrinque glauca. Petiolo superiores ad 6″ lg. Lamina magis nunc ad ovatum nunc ad lanceolatum accedens, versus apicem sensum angustata 4–6′ lg., ∝ 2′ lt., nervo primario pallido.

An *E. longifolia*? Link. Enum. Nonullis quadrans, aliis discrepans. Differt enum potissimum : foliis plurimis basi non inaequilibus, nullis ullo modo punctatis, coloris valde glauci, qui tamen in aliis, *e.g.*, purpurascente, expresse memoratur, nullâ mentione, acumine non incurvo, ita ut illam credere non audeam. Quousque sese extendat identitas, pronuncient comparantes arbitri me peritiores.

Peregrinator quidam dixit, eam a cl. Wendland *E. glaucescentem* vocari; alii peritiores, meam aliam, novamque sp., asserunt." (Hoffmg. Verz. Pfl. Nachtr. 2, p. 113.)

Schauer in *Walpers' Repertorium* ii, 927, says this is *E. splachnicarpa* Hook. I have not seen the type, but agree with Bentham that it is "very doubtful," particularly as there is an absence of glaucousness in the foliage of *E. calophylla*.

RANGE.

The type came from near Cape Leeuwin, Western Australia, and the species has not been found out of that State. Schauer says it is found around Perth and "totius coloniae."

Bentham says "Common about King George's Sound, *R. Brown*, *Fraser*, *Oldfield* and others; and thence to Swan River, *Fraser*, Drummond No. 150; *Preiss's* No. 250; rare towards Port Gregory, *Oldfield*."

Mueller (" Eucalyptographia ") puts it this way : " Interspersed accompanying *E. marginata* through nearly the whole area of that species, but less gregarious, reaching its northern boundary about the Hill River, and the southern at King George's Sound, mixed also into the forests of *E. loxophleba* (*fœcunda*), but not into those of *E. diversicolor*, preferring a richer and deeper soil than *E. marginata*."

It is a lover of good soil and well-watered districts, and forming as it does a large, picturesque, often scrambling tree, with huge branches, occurring exclusively over large areas, it gives to country what is known as a " park-like " aspect. It occurs within a line roughly connecting Cape Riche and Port Gregory, but we do not fully know the localities north and east of that line.

I have seen the following :—

A specimen labelled " *E. calophylla* Lindl. No. 250 of Mr. L. Preiss, 1837–1840, Swan River." Also Drummond's No. 150 (presented by British Museum through Dr. A. B. Rendle).

Following are " modern " specimens in the National Herbarium, Sydney :—

King George's Sound (B. T. Goadby, No. 90). Albany (Henry Deane, R. Helms, J.H.M.). Shrub of 2–3 metres, flowers sweet-scented; near King George's Sound (Dr. L. Diels, No. 2188). " South West Plantagenet " (Dr. E. Pritzel, No. 250). Denmark (Dr. F. Stoward, No. 159). Bow River, also Wilson's Inlet and Deep River (Sidney W. Jackson, presented by Mr. H. L. White). (These are as near to the type locality as I have got; they are a few miles to the east of it.)

Foot of Stirling Range near Mt. Tulbrunup. Juvenile leaves perfoliate (J.H.M.). (This is as far east as I have seen it. It is very abundant in the locality, and has by no means petered out in the district).

Jarrahwood (Forest Ranger Wm. Donovan). Preston Valley, with perfoliate juvenile leaves (Max Koch, No. 1855). (The above are connecting localities between the extreme south-west and the York district.)

Tree of 20–30 feet. Thick, rough, brown, spongy bark. Growing in black humus, foot of hill near Cut Hill, York (O. H. Sargent, No. 280). Bald Hill, near York (O. H. Sargent, No. 421).

Following are in the Perth district :—

Greenmount (Dr. Stoward, No. 285). Guildford (W. V. Fitzgerald). Woodlupine Creek near Perth (A. G. Hamilton). Perth (Dr. J. B. Cleland). Lower Canning River (Dr. A. Morrison, No. 28).

The following locality is on the Midland Railway. 25 metres high, Gingin (Dr. L. Diels, No. 1945). This is the same as the Moore River.

Mueller gives the Hill River (which is on the same parallel as Watheroo, on the Midland Railway) as the northern limit, but this is greatly exceeded towards the north by Port Gregory (Oldfield) which is near Northampton, which is again north of Geraldton.

AFFINITIES.

With *E. ficifolia* F.v.M.

Bentham's contrast in the Key (B.Fl. iii, p. 199) is—

Seeds large, not winged ... ... (*E. calophylla*).
Seeds (very irregularly) winged ... (*E. ficifolia*).

This contrast has to be taken philosophically. While the seeds of *E. ficifolia* appear to usually have more wing than those of *E. calophylla*, those of the latter species are sometimes not without a winged appendage.

This species, as far as is known, is related to *E. calophylla*, but is very distinct in having pale brown, smaller seeds and a transparent wing running down the back as long or longer than the nucleus. The leaves resemble those of certain species of *Ficus* of the series of *F. elastica*. (Translation of original description of *E. ficifolia*.)

The characteristics by which *E. ficifolia* can be distinguished from *E. calophylla* are as follow :— The tree is of less height, the bark is somewhat more deeply furrowed, the leaves are proportionately not quite so broad but longer, the flowers are mostly larger, the calyces assume a reddish hue, the filaments are of a splendid crimson [see my remarks below.—J.H.M.], the fruits less turgid, while the seeds are much paler in colour, have a smaller kernel, and are provided with a conspicuous appendicular membrane. Irrespective of this a very marked difference in the seedlings is observable, as those of *E. ficifolia* show only slighly or not at all the bristly roughness of *E. calophylla*, nor are the seedling-leaves inserted above their base to the stalk, as in that species. (" Eucalyptographia," under *E. ficifolia*.)

Bentham (B.Fl. iii, 256) pointed out that " certain flowering specimens of *E. ficifolia* are indistinguishable from *E. calophylla*, which may possibly belong to this species (*ficifolia*)."

The seedling of *E. ficifolia* is described at i, 533, of Lubbock " On Seedlings," and that of *E. calophylla* at the same place, and also fig. 344. There is a seedling of *E. calophylla* figured at the back of the plate of *E. calophylla* in " Eucalyptographia." It is difficult, and perhaps impossible, to lay down important differences between the seedlings of *E. ficifolia*, *calophylla* and *hæmatoxylon*. All are more or less scabrous, with large cotyledon leaves (those of *E. calophylla* are especially large), and with early peltate leaves. I prefer to leave the matter of seedlings to a subsequent Part, when those belonging to some hundreds of species can be compared as a whole, which is the true method to elucidate affinities.

The following notes contrasting *E. ficifolia* and *E. calophylla* lay especial stress on the colours of the filaments in the two species, and deal with a hybrid form.

Everyone who knows Sydney and Melbourne, and who pays attention to horticultural matters, must have noticed the great development, during the last few years, of the cultivation of what the ordinary citizen calls " Flowering Gums." By this he means with flowers comparatively large in size and other than white in colour. Some people, a little more definite, simply call them Red-flowering, and many, Scarlet- or Crimson-flowering indiscriminately, using the terms scarlet and crimson as if they

were interchangeable, just as they are said to be both " red." As one to whom flowers of various kinds are often sent, I find that, as often as not, when a man writes " scarlet " he means " crimson," and *vice versa*. In the case of trees like Eucalypts and Kurrajongs, which include both scarlet and crimson flowers, the confusion may be inconvenient.

Colour of Flowers (*filaments*).—The colour of the filaments of *E. ficifolia* F.v.M., is not given in Mueller's original description, but is stated to be " crimson " in " Eucalyptographia," in the first half of the formal description, but in the second half it is described as " beautifully cinnabar-red, occasionally varying to a lighter colouration, but never very pale." Further down, in contrasting *E. ficifolia* with *E. calophylla*, he says, " the filaments (of *E. ficifolia*) are of a splendid crimson." This may be carelessness, but it probably arises from a not very clear knowledge of English terms for the colours concerned.

I have received from Dr. G. P. U. Prior, Mental Hospital, Rydalmere, near Sydney, flowers which are true *E. ficifolia*. They are bright scarlet in colour or, in in the language of Plate No. 79 of Rép. de Couleurs, bright fiery-red or russet-orange. The filaments do not contrast with the whitish anthers, for the pollen-masses are scarlet, too. The calyx-tubes are suffused with scarlet, and so the whole inflorescence is of a uniform tone of colour.

Supplementary Note.—We have an indubitable *E. ficifolia* flowering in the Botanic Gardens, Sydney (January, 1920), which has all the morphological characters of the species, but the rich-coloured filaments (Dauthenay Plate 114), with stamens hardly in contrast, are rich crimson red, and do not belong to the orange or scarlet series at all. Evidently we must take more evidence in regard to these forms.

Dr. Prior's No. 2 is a shrub at present; it is the *E. ficifolia alba* of nurserymen; it has white filaments, with a suspicion of colour at the base, arising from the coloured rim. Calyx-tube green. A little colour on the operculum.

In *E. calophylla* R.Br. the filaments are white or creamy, and I saw the trees in flower over large areas in their native habitats. Mr. W. V. Fitzgerald states that the filaments are " rarely pink "; this indicates a tendency.

This muddle that Mueller got into as regards the filaments of *E. ficifolia* is continued by the nurserymen. Large numbers of plants are sold; indeed, the demand exceeds the supply. I need scarcely observe that precision is desirable, and sometimes necessary, in speaking of the colours of flowers. The following is a useful work of reference :—" Répertoire de Couleurs (quoted as Rép. de Couleurs) publié par la Société Française des Chrysanthémistes," &c. (Rennes and Paris, 1905). Two portfolios of plates and a handbook.

In Vilmorin's (Paris) Catalogue of Plants, the colour of the flowers of *E. ficifolia* is given as " rouge carmin," which is not a colour admitted, as such, into Rép. de Couleurs. The firm is evidently following the late M. Naudin, a great French authority on the genus, who, Mém. Eucal. i, 555, says :—" *E. ficifolia* qui les a d'un rouge carmin très brillant, au moins dans une de ses variétés."

In examining the catalogues of good Australian firms, I find the following given under *E. ficifolia* :—

1. " Red-flowering Gum," 20 feet. This colour may mean any thing.

2. Scarlet, 15 feet; " Scarlet-flowering Gum," 15 feet. Scarlet is correct.

3. Crimson, 20 feet; Crimson-flowered Gum, 20 feet; " Bright Crimson," 15–20 feet. This may or may not be a confusion with scarlet, as begun by Mueller; I shall have something to say about a Crimson-flowering Gum presently. See also p. 79.

Then one firm has :—

6. " Scarlet-flowering Gum, 15 feet, literally a blaze of beautiful rich crimson shade."

In examining the catalogues of Australian nurserymen I cannot find one which describes the colour of *E. calophylla* correctly. It should be white. One firm calls it " rich pink."

Several firms, however, have *E. calophylla rosea* in their lists, either without comment, or " Bright pink, 30 feet," or " Similar to *E. ficifolia*, but rosy pink flowers."

I think this view of the case is correct; the rose- or crimson-flowering forms, which are large-growing (getting size from their *calophylla* parent, and their colour more or less from their *ficifolia* parent). The habit of these trees reminds me more strongly of *E. calophylla* than of *E. ficifolia*, and as to colour, we have them of all shades of the faintest blush-pink (almost white) to deep crimson.

The flowers of *E. ficifolia* and *E. calophylla* are honey-smelling, the perfume heavy and oppressive in a room. They flower mostly in December and January, and the climatic conditions in Sydney during the last season have induced an exceptionally fine display of bloom.

I have received from Dr. Prior flowers, fruits and seeds of what I call No. 1. The flowers are Tyrian Rose in colour; see Plate No. 155 of Rép. de Couleurs. There is a short, white attachment to the anther, which is creamy-white in colour, with a line of Tyrian Rose running round the back, and this colour is sometimes blurred. When old, the anther-cells inside take a pinkish shade. The pollen is creamy-white

In *Proc. Roy. Soc. Qsld.*, x, 17 (1893), the late F. M. Bailey described " what is probably an accidental sport" in the Melbourne Botanic Gardens, with flowers of a " deep rose" as *E. ficifolia* var. *Guilfoylei* . . . " It proved to be only a form of *E. ficifolia* differing from the normal plant in its smaller foliage, more compact inflorescence, different colour of flowers, with prominent umbo to the operculum and slight difference of seed-wing. I have received specimens of this form both from the late Mr. Guilfoyle and from Mr. J. Cronin. The yellow anthers contrast well with the filaments. The calyx-tubes are urceolate and apple-green, and both on account of the contrast of filaments with anthers and calyx-tubes, the effect in the mass is most charming.

The Rydalmere tree is 40 feet high, and flourishing. In every respect that I can see, it is identical with *E. ficifolia* var. *Guilfoylei* and *E. calophylla* var. *rosea* Hort., and I am inclined to think that the more reasonable view is to look upon it as a form of *E. calophylla*. The habit and size of the hybrid incline to those of *E. calophylla*, while the pink or purple tinge (in contradistinction to the scarlet of *E. ficifolia*) naturally occurs in *E. calophylla*.

Size and habit.—*E. calophylla* is a huge tree, with gnarled trunk and scrambling, umbrageous branches, the counterpart of the Apple (*Angophora intermedia*) of eastern Australia. The size is given as up to 150 feet, with a stem-diameter of 10 feet (" Eucalyptographia "), and I am certain this is not exaggerated.

E. ficifolia, on the other hand, is a small tree; I think it rarely exceeds 30 feet in height, and it is usually erect, and not scrambling.

The hybrid may be fairly stated as intermediate in size.

Seeds.—Those of *E. calophylla* are large, ovate, black, flat, and with a raised angle on one face, the edges acute but scarcely winged, the hilum large on the inner face.

Those of *E. ficifolia* are of a pale colour, testa expanded at one end, or round one side into a broad, variously-shaped wing (B.Fl. iii, 256). The hilum is towards the end of the seed, and furthest from the wing.

The seeds of the *E. calophylla* x *E. ficifolia* hybrid are flatter than those of *E. ficifolia*, and also paler in colour. As compared with those of *E. ficifolia*, they are a little darker and less winged, but the hilum is more remote from the wing. In other words, they are intermediate between the two species. Most of the seeds are, however, sterile, and these are pale reddish-brown in colour, shining, and mostly boomerang-shaped.

The sterile seeds of *E. calophylla* are similar in shape, perhaps a little darker in colour.

It seems to me that, in this rose-crimson series, we have incontrovertible evidence of hybridisation, the two most obvious factors being colour and size; and I, therefore, add *E. calophylla* and *E. ficifolia* to the very long list of pairs of species of which the evidence that they hybridise appears to be sufficiently clear.

I have touched on the general question of hybridisation in the genus in *Report Aust. Assoc. Adv. Science*, 1904, p. 297, in the Proceedings of this Society, xxx, p. 492 (1905), and on many other occasions. (Maiden in *Proc. Linn. Soc. N.S.W.*, xli, 185, 1916.)

DESCRIPTION.

CCXXXVIII. E. hæmatoxylon Maiden.

In *Proc. Roy. Soc. N.S.W.*, xlvii, 218 (1913).

Arbor parva altitudinem 20′ et trunci diametrum 18″ attinens, "Mountain Gum" nominata. Bloodwood typicus. Cortex stratis mollibus rubris secedens. Lignum rubrum, gummi venis. Folia petiolata lanceolata ad lato-lanceolata, coriacea, 8-9 cm. longa 2–3 cm. lata. Venae secundariae tenues et fere paralleles. Flores in corymbo irregulare. Filamenta alba. Fructus ovoidei vel fere sphaerici, aliquando orificio constricti, urceolati, 3 cm. longi, 2·5 cm. lati. Orificium 1 cm. latum.

A small tree, attaining a height of 20 feet and a trunk diameter of 18 inches. "Much resembling *E. calophylla* R.Br., the 'Red Gum,' in general appearance." Known as "Mountain Gum." It is a typical "Bloodwood."

Bark.—In soft reddish flakes, typically that of a "Bloodwood."

Timber.—Red, with gum veins, stated to be "very soft"; a typical Bloodwood timber, hence the specific name suggested.

Juvenile Leaves.—Broadly lanceolate, thin-membranous, reddish purple, petiolate, margin thickened, secondary veins very fine and nearly parallel to each other. Containing caoutchouc.

Mature Leaves.—Petiolate, lanceolate to broadly-lanceolate, symmetrical or somewhat oblique, apex attenuate-acuminate, coriaceous and of medium thickness, equally green on both sides, margin thickened, intramarginal vein not far removed from the edge. Secondary veins fine and nearly parallel to each other. Length say 8 or 9 cm., and breadth 2–3 cm.

Buds.—In a large corymb consisting of individual umbels of four to seven. Each peduncle thin, flattened, ribbed, and about 2·5 cm. long; the pedicels similar but slenderer, and from 1 to 1·5 cm. long. The bud club-shaped, the operculum pointed, short, less than half as long as the calyx-tube, which is contracted at the orifice, and which does not taper gradually into the pedicel.

Flowers.—Filaments cream-coloured, stamens inflected in the bud, the anthers all fertile, long and somewhat pale, opening in parallel slits, small gland at the top; versatile.

Style ribbed, the stigma hardly exceeding it in thickness.

The anthers, style and stigma appear to be identical with those of *E. corymbosa*.

(The description of the buds and flowers, *op. cit.* xlviii, 432 (1914).)

Fruits.—Ovoid to nearly spherical, sometimes constricted at the orifice, thus taking on an urceolate shape. Large, 3 cm. long and 2·5 cm. broad, with an aperture of 1 cm. and less. Tips of valves well sunk. Seeds large, wing rudimentary.

RANGE.

It is confined to south West Australia so far as we know at present. Specific localities are :—

Happy Valley, Jarrahwood Railway, Western Australia. Generally in poor, sandy country (Forest Ranger W. Donovan, July, 1912).

" Mountain Red Gum." Height 30–40 feet and up to 12–18 inches in diameter. Trees are of a stunted nature, and the wood is very faulty. Grows in ironstone country in the mountains with Jarrah, between Busselton and Jarrahwood. (Dr. F. Stoward, No. 108.)

AFFINITIES.

The affinity at once suggested is *E. ficifolia* F.v.M., but the filaments of the new species are white, and the fruits are of a different shape, viz., smaller and more spherical, those of *E. ficifolia* being somewhat cylindroid. The seeds of the latter species also are winged, its bark is more fibrous and its timber paler; it lacks the rich cedar-coloured timber of the present species.

It is also allied to *E. calophylla* R.Br., a much larger tree. The three species are closely related, and all have very large, handsome cotyledon leaves, and the young leaves soon become more or less peltate, but the character is apparently most common in *E. calophylla.*

DESCRIPTION.

CCXXXIX. E. maculata Hook.

In *Icones Plantarum*, t. 619 (1844). The figure shows mature leaves, buds and flowers.

FOLLOWING is a translation of the original description :—

A tall tree, the trunk spotted, leaves alternate, petiolate, lanceolate, drawn out into a long point, pellucid-dotted, purplish at the edges, copiously and distinctly veined, obliquely spreading, panicles axillary and terminal, sparsely branched, shorter than the leaves, operculum double, the external one conical-hemispherical, mucronate, shorter than the sub-angled calyx-tube, the interior one (the corolla) hemispherical membranous, shining. Spotted Gum, MSS. No. 37. (The type is therefore doubtless Backhouse's No. 37 from the Maitland district, see p. 87.)

The rest of the description is in English, and is as follows :—

A large tree, Mr. Backhouse observes, of which the bark falls off in patches, giving it a spotted appearance. The timber is nearly equal to oak, but the sap or outer layers decay rapidly. The lid or operculum is double, inner one membranaceous; this inner one has justly been considered by Mr. Brown as the corolla, and it here forms an exactly hemispherical glossy membranaccous cup, which often continues to adhere after the outer one has fallen away. "The gum from the tree contains benzoic acid." (*Backhouse.*)

It is described as follows by Bentham :—

A lofty tree with a smooth bark falling off in patches so as to give the trunk a spotted appearance. *Leaves* ovate-lanceolate or lanceolate, straight or falcate, acuminate, mostly 4 to 6 inches long or even more, with numerous parallel but rather oblique veins, not so close as in the preceding species (*E. pyrophora*), and rather coarse, the intramarginal one close to the edge. *Umbels* 3-flowered, usually several together, on short leafless branches, forming a panicle or corymb. *Peduncles* and pedicels short and thick, scarcely angular. *Calyx-tube* in the young bud shortly cylindrical, when open broadly turbinate, 3 to 4 lines diameter. *Operculum* hemispherical, much shorter than the calyx-tube, the outer one much thicker and more persistent than in most species where it has been observed, and usually umbonate or shortly acuminate, the inner one (corresponding to the single one of most species) thin, obtuse, smooth and shining. *Stamens* attaining 4 or 5 lines; anthers ovate with parallel distinct cells opening longitudinally. *Ovary* flat-topped. *Fruit* ovoid-urceolate, usually about ½ inch long, and nearly as much in diameter, the rim narrow, the capsule deeply sunk. (B.Fl. iii, 258.)

Mueller figured and described it in the "Eucalyptographia." Some additional notes on the species, which need not be reprinted here, will be found at Vol. I, p. 154 of my "Forest Flora of New South Wales."

This is the common Spotted Gum of New South Wales and Queensland, because of the mottled appearance of its smooth bark. There are other Spotted Gums, but none more characteristic in appearance than this.

"Yah-ruigne" was the name of the aborigines of the Illawarra, and "Booangie" of those of Cumberland and Camden, N.S.W., according to the late Sir William Macarthur. Mr. Forester Allan tells me that "Thurraney" was the name used by the South Coast blacks. "Urar" is a Brisbane name, according to Mr. T. Petrie. "Kangar" is a name employed by Queensland aborigines to denote the variety *citriodora*.

Many years ago Mr. Charles Hedley informed me that in Queensland certain persons were affected by what is known as "Spotted Gum rash" after handling timber of this species. He instanced one case (at Maryborough) in which a man was habitually so indisposed after touching sawn Spotted Gum that he declined to handle it further. This acridity of the sap must be rare, as I have only heard of one other case, and this was in New South Wales. I have dealt with the matter in regard to other Eucalyptus timbers in my "Forest Flora of New South Wales," Vol. V, p. 175.

RANGE.

The original describer quoted the following localities for the species :—"Interior of N. Holland (*Fraser*) [which was not far from the coast.—J.H.M.] ; Maitland, Liverpool and Newcastle (*Backhouse*)." Liverpool is about 20 miles south of Sydney, and Newcastle and Maitland are about 100 miles to the north.

It is confined to eastern Australia, extending from Gippsland, Victoria, in the south, from south to north of New South Wales, along the coast and coastal ranges and in Queensland to at least as far north as the Rockhampton district, while the variety *citriodora* occurs as far north as the Gulf of Carpentaria. It prefers ridges and poor country, and is commonly found with Ironbark.

Victoria.

In "Eucalyptographia," under *E. Watsoniana*, Mueller records that Reader found *E. maculata* in the neighbourhood of the Genoa River. It was subsequently known from a specimen sent by Mr. J. H. King to the late Dr. A. W. Howitt, from the eastern slope of a spur from the Tarra Mountain, on the track from Buchan to Orbost, Gippsland, and about 15 miles from the former place, where it forms a small compact colony of a few acres in extent. (*Vict. Nat.*, xiii, 150, 1897.) I hope our southern neighbours will connect this locality with the most southern of New South Wales localities, for I do not know any very close to the border of the two States.

New South Wales.

Southern Localities.—"The Spotted Gum practically disappears after crossing the Bega River near Tathra. I believe there is no sign of Spotted Gum at Eden, and none between Eden and the Victorian border; there is a forest or two about Bermagui; there is also some between here (South Bermagui) and the Bega River, but once the Bega River is crossed the tree is lost." (Forest Guard W. Dunn.)

Bodalla district (Dromedary Mountain). (W. Baeuerlen.)

Having travelled about much in localities where the Spotted Gum occurs, I notice that it is usually accompanied by the Burrawang (*Macrozamia spiralis*)—both sure indications of poor soil. Usually when the Burrawang disappears, Messmates, Stringybarks, &c., make their appearance and the Spotted Gum disappears. Sometimes I travel for miles over a tract of country where I see no Burrawang, but as soon as I notice the Burrawang making its appearance again I always expect that the Spotted Gum will appear also, which is usually the case. (W. Baeuerlen, writing from Bat man's Bay.)

George's Basin and Wandandian and South Coast road generally (J.H.M.). With intermediate leaves. Milton (J. L. Boorman). Nowra (J.H.M.).

A specimen in Herb. Kew in bud only labelled "Sydney Woods, Paris Exhib. No. 95, Spotted Gum, 100–150 feet; W. Macarthur, 1854," is *E. maculata*. To trace the history of this specimen we must turn to the N.S.W. Catalogues of the Paris Exhibition of 1855 and of the London Exhibition of 1862. In the former catalogue it is called "Spotted Gum" and "Mottled Gum," and the aboriginal name is given as "Yah-ruingne." In the latter catalogue Illawarra is given as the place where the name is in use, and "Booangie" as the name in the Counties of Cumberland and Camden.

We now leave the South Coast, and the following locality is on the tableland, perhaps as high (2,500 feet) as I have met it. Nye's Hill, Wingello (not common). (J. L. Boorman.)

Very large intermediate leaves. Theresa Park to Werombi, Camden district (J.H.M.). Liverpool to Bringelly (J.H.M. and J. L. Boorman). "I believe picked up at Mulgoa, April, 1810." (Copy of label in George Caley's handwriting, British Museum, No. 43.)

On sandy shale, ¾ mile south of Prospect Hill, near Parramatta (R. H. Cambage, No. 3590). We are now practically at Sydney.

Following is an admirable account of the range of the species chiefly on the "South Coast" of New South Wales, and with particular reference to the geological formations on which it occurs :—

E. maculata . . . . occurs just where the monoclinal fold, already alluded to, has thrown down the shales and exposed the Hawkesbury Sandstone, about 4 miles before The Oaks is reached. This species . . . is widely distributed throughout the coastal districts of New South Wales. By the casual observer, erect trees of *Angophora lanceolata* are sometimes mistaken for *E. maculata*. In going south from Sydney along the Illawarra railway line, the Spotted Gum is not seen, except for a few trees just beyond Wollongong, until the neighbourhood of Nowra is approached, after which it becomes common, and occurs at many points along the Milton road, such as at The Falls, and beyond Tomerong, where the geological formation is of Permo-Carboniferous age. It is absent, however, from the igneous formation of Milton, but reappears to the south immediately the sedimentary rocks are reached, being plentiful towards Bateman's Bay and also at Wagonga, where some of the very finest specimens of this species may be found. It extends into the north-eastern part of Victoria, but is only very sparsely represented in that State. On parts of the North Coast of New South Wales it is a common tree, and occurs in the Maitland-Singleton district on the Permo-Carboniferous formation in company with *E. crebra*, the Narrow-leaved Ironbark. It extends to within about 20 miles of the Great Dividing Range at Crooked Creek, on the Tenterfield-Casino road. *E. maculata* is decidedly rare, however, in the Sydney district, and generally speaking, appears to avoid the Hawkesbury Sandstone formation. There are a few exceptions to this discrimination, one being its occurrence on the sandstone just near the monoclinal fold from The Oaks to the western side of Mulgoa, while others are at Newport, and on the Appin road, about 5 miles from Campbelltown. At Newport, the Spotted Gum is growing on the rocks which form a remnant of the base of the Hawkesbury

Sandstone immediately overlying the Narrabeen Shales; while at The Oaks and near Campbelltown it occurs on the top of fairly thick beds of Hawkesbury Sandstone, from which the overlying Wianamatta Shale is, in places, only just barely removed. Observations in regard to the distribution of this species tend to show that it does not seek either a highly siliceous sandstone, or a shale or slate of basic origin, but flourishes best where there is a combination of the two; and while it usually avoids the Hawkesbury Sandstone areas, as too siliceous, it is also absent from the deepest portions of the Wianamatta Shale. Its occurrence on this latter formation denotes the presence of sand in the vicinity. (R. H. Cambage, in *Proc. Linn. Soc. N.S.W.*, xx vi, 551 (1911).)

Western Localities.—In New South Wales the most western locality known to me is Poggy, a wild district a few miles from Merriwa. There is also some on the Mudgee. Cassilis road. Parish of Curryall, County of Bligh (Forest Guard J. B. Yeo). This is in the Cassilis district.

Northern Localities.—Occurs on the Ranges at Ourimbah, 6 miles from Gosford (J.H.M.). Near Clarence Town (Forest Guard Ikin).

Common between Newcastle and Maitland (J.H.M.). Maitland (James Backhouse, No. 37, about 1837). Presented by Kew. The type. Ravensworth (Forest Guard L. A. MacQueen). Dungog (W. F. Blakely).

Taree (E. H. F. Swain).

Anderson's Sugar Loaf, Macleay River (J. L. Boorman).

Grafton to Coff's Harbour (J.H.M. and J. L. Boorman). South Grafton (Henry Deane). Lawrence, Clarence River (J. V. de Coque). Lower Southgate, Clarence River (W. W. Froggatt). Very large intermediate leaves; Copmanhurst, Upper Clarence River (J. L. Boorman). Casino, Richmond River (District Forester Pope).

QUEENSLAND.

Canungra, near Mt. Warning (J. L. Boorman.)

Enoggera, Brisbane (F. M. Bailey). With young peltate leaves, Brisbane (J.H.M.). " Fairly large trees of 60–80 feet, with a diameter of 3–4 feet still remain, where it has been preserved against the constant demands on this valuable timber." Waterworks road, Brisbane (J. L. Boorman). Aspley, 5 miles north of Brisbane (E. Bilbrough).

" Spotted Gum, Burro, Taylor's Range." (Dr. L. Leichhardt, 1843.)

Hatton Vale, Laidley (W. H. Pimlott).

Kalbar (formerly Engelsburg), 76 miles west of Brisbane, *via* Ipswich and Dungandan (W. H. Martin).

Goomboorian Range, near Gympie (R. N. Jolly). Brian Pastures, Gayndah (S. A. Lindeman). Bundaberg (J.H.M.). East of Rockhampton, near sea coast (P. MacMahon).

The allusions to Spotted Gum by Leichhardt in his " Overland Expedition " are few; two of them are at pages 20 and 48. On the banks of Hodgson's Creek he points out that Spotted Gum and Ironbark (a combination often confirmed since Leichhardt's time) formed the forest, while at Robinson's Creek (p. 48) he found the same two species.

VARIETY.

Var. *citriodora* F.v.M.

I have gone into the question of whether *E. citriodora* is a variety of *E. maculata* or not at pages 154, 155, 164, of Vol. I of my " Forest Flora of New South Wales."

Mueller (*Fragm.* ii, 47) used the name *E. citriodora* and so did Bentham (B.Fl. iii, 257). The latter, by placing it between *E. corymbosa* and *E. terminalis*, indeed he says " evidently very closely allied to *E. corymbosa*," did not realise its close affinity to *E. maculata*, although he remarks, under *E. citriodora*, " Woolls' Spotted Gum from Parramatta [which is *E. maculata*.—J.H.M.] is very much like *E. citriodora*." Later, Mueller (" Eucalyptographia," under *E. maculata*) thus speaks of it :—

> *E. citriodora* can only be considered a variety of *E. maculata*, differing merely in the exquisite lemon-scent of its leaves, and holding as a variety precisely the same position to *E. maculata* as *Boronia citriodora* to *B. pinnata*, or *Thymus citriodorus* to *T. Serpyllum*. Mr. Bailey, who had opportunities to compare the two trees promiscuously growing, confirms their specific identity.

Under the circumstances it seems proper to attribute the authorship of the variety to Mueller.

Mr. Bailey, in his " Queensland Flora," records it as *E. maculata* var *citriodora*.

I have occasionally crushed the young foliage of *E. maculata* and detected the *citriodora* perfume. This was the case in some specimens collected by Mr. J. L. Boorman at Copmanhurst, Clarence River.

Messrs. E. Schimmel & Co., Miltitz, Saxony, in " The Volatile Oils " (Gildemeister and Hoffman, p. 536), describe the oil of *E. maculata*, and say that " it cannot be distinguished from the following oil (*E. citriodora*)." See my " Forest Flora " i, p. 155. This means that, while the oil of *E. maculata* is less in quantity, its composition is similar to that of *E. citriodora*.

An adaptive character, like the presence of oil, cannot or should not in itself be used for specific determination.

That is the evidence. The two trees (*maculata* and its variety *citriodora*) do not differ in important morphological characters (the young shoots of the latter are more hairy, and perhaps the leaves are narrower and the buds less pointed, but these differences do not amount to much), and their oils run into each other, the relative proportion of Citronellal being vastly greater in the latter. Here, there seems to me, is a case of a variety clearly enough, and as I think that the term variety is a useful botanical designation, I employ it in the present instance.

At the same time, the distiller and seller of oil (like the forester and gardener) are not to be blamed if they choose the simple descriptive name " *Eucalyptus citriodora* " for the unwieldy one of " *Eucalyptus maculata* variety *citriodora*." Although I would much like to see trade names approximate to the botanical ones, ordinary people will have to be more educated before they will accept ponderous names for everyday use. The application of botanical names is subject to laws; trade names, which sometimes simulate them, are not so controlled, and divergences between the two kinds of names are sometimes inevitable.

There is a note on the size of this tree at Wide Bay, Queensland, and on a planted one in the Sydney Botanic Gardens, in Dr. George Bennett's "Gatherings of a Naturalist in Australasia" (1860), p. 265. Dr. Bennett got Mr. Norrie, the Sydney chemist, to distil the leaves for oil and the specimen was sent to Kew, and must have been one of the earliest prepared from the species.

SYNONYMS (of variety).

1. *E. citriodora* Hooker, in Mitchell's *Journ. Trop. Austral.*, 235.

A translation of the brief Latin description is as follows :—

Branches angular, brownish, minutely tuberculate, leaves broad-lanceolate, petiolate, pinnulate, spreading parallel veined, green (not glaucous).

Then follows the statement :—

Sir William Hooker has ventured to name this Eucalyptus, though without flower or fruit, from the deliciously fragrant lemon-like odour, which exists in the dry as well as the recent state of the plant.

I have seen the following specimens :—

(*a*) "1846, July 16, No. 153 bis. Sub-tropical New Holland, Lieut.-Col. Sir T. L. Mitchell. *Eucalyptus citriodora.*"

(*b*) "1846, July 17, No. 217. Height 6 feet. [Evidently young scrub, not yet arrived at the flowering stage.—J.H.M.] Leaves perfumed like lemon. Sub-tropical New Holland. Lieut.-Col. Sir T. L. Mitchell. *Eucalyptus citriodora* Hooker, 204."

(*c*) "*Eucalyptus citriodora* Hook., Sub-tropical New Holland, Col. Mitchell." All in Herb. Cant. All in leaf only; (*b*) in young leaf, (*a*) and (*c*) in older, broad, shining and markedly veined. All are *E. citriodora* Hook. ; (*a*) and (*b*) are ex Herb. Lindley.

Imperfect specimens were described by Bentham in B.Fl. iii, 257, as *E. citriodora*, from Balmy Creek, *Mitchell*, and Wide Bay, *Moore*.

2. *E. melissiodora* Lindley in Mitchell's *Journ. Trop. Austral.*, 235. (non F.v.M., which = *peltata*.)

The brief description is in Latin, which may be translated as follows :—

Branches ferruginous-tomentose, scabrous, leaves on both sides with rusty papillae, scabrous, ovate oblong obtuse, peltate above the base (flowers and fruits unknown).

I have examined the following specimens :—

(*a*) "No. 153, July 16, 1846. Sub-tropical New Holland. Lieut.-Col. Sir T. L. Mitchell. Height 5 feet. 'Strong balm scent.' Eucalyptus ? melissiodora." Herb. Cant. ex Herb. Lindl.

(*b*) " Eucalyptus melissiodora Lindl. Sub-tropical N. Holland. Col. Mitchell." Herb. Cant.

The label of (*b*) is in the same handwriting as (*c*) var. *citriodora* (I think Lindley's handwriting).

The principal difference between the type specimens of *melissiodora* and *citriodora* lies in the greater amount of rusty tomentum on the leaves and stem of the former. The difference is, however, very slight and variable.

E. melissiodora was described by Mitchell, when he first came across it, as having " a powerful odour of balm." (*Melissa officinalis.*)

At the same time and place he found " another bush, with leaves of the same shape, and glossy, but having a perfume equally strong of the lime." This was called *E. citriodora.* Neither species had flower or fruit.

Bentham (B.Fl. iii, 254) doubtfully describes this in the following words :—

A shrub, exhaling a powerful odour of balm, and covered with a rusty resinous pubescence, short and scabrous on the foliage, almost bristly on the branchlets. Leaves oblong-lanceolate, obtuse, more or less peltately inserted on the petiole above their base, the veins transverse, but not close. Flowers and fruit unknown.

Queensland.—Sandstone rocks, Balmy Creek, *Mitchell.* Possibly a barren state of *E. citriodora* or some allied species, in which the leaves of the flowering branches are not peltate.

3. *E. variegata* F.v.M. in *Journ. Linn. Soc.*, iii, 88 (1859). The specific name was given because of the appearance of the bark.

Following is a translation of the original :—

A tree, branchlets angular, leaves alternate, moderately petiolate, lanceolate-linear or narrow-lanceolate, falcate elongate, long acute, shining, thickly penniveined, covered with pellucid dots, peripheral vein very close to the edge, umbels paniculate, 3-flowered, the calyx-tube semiovate, twice as long as the hemispherical operculum, and like it ecostate, fruits truncate-ovate, 3-celled, 2–4 times longer than the pedicel, ecostate, smooth at the vertex, valves included, seeds winged. Habitat in the grassy hills near the Burnett River. Flowering in the summer.

A rather tall tree, trunk smooth, ashy-white, variegated with the grey or dirty reddish outer layer of the bark. Leaves mostly 4–7 inches long, and an equal number of lines broad. Peduncles 2–3 lines long, angular. Buds ovate. Fruits 5–6 lines long, gradually contracted at the apex.

Called Spotted Gum-tree by certain of the colonists. In habit it hardly differs from *E. tereticornis* and *E. rostrata*, except in the trunk, which is stripped of the outermost layers of bark as far as the base, and not covered with old woody, flaky, wrinkled layers of bark.

RANGE (of Variety).

The type came from Balmy Creek, a name given, presumably, because of the presence of this tree, whose odour reminded Major Mitchell of Balm. See Mitchell's "Tropical Australia," p. 235, and it is marked on his map, opposite p. 189. It is south of Mantuan Downs, and Dr. J. Shirley informs me that it is 20–30 miles west of Springsure.

In his "Queensland Flora" Bailey records it from Gladstone, Rockhampton, Springsure, Herberton and Port Denison.

In the Catalogue of the Queensland Forestry Museum (1904) the record is given "Plentiful around Gladstone and the Port Curtis district, Rockhampton, west side of Eungella Range (Mackay district), Herberton, Mount Garnet, and a large quantity on the Hughenden-Charters Towers Railway Line."

With peltate young growth. (Queensland, recorded as *E. melissiodora* Lindl.; with no further details.)

Bundaberg and Gladstone Railway (correspondent of F. M. Bailey).

Duaringa, 65 miles west of Rockhampton (J.H.M.). O'Shanesy points out that *E. exserta* and *E. citriodora* are often found in company. See this work, Part XXXII, p. 35.

"Scented Gum," Stannary Hills. (Dr. T. L. Bancroft.) Irvinebank (correspondent of F. M. Bailey).

Dr. H. I. Jensen informs me that the Lemon-scented Gum abounds on mixed soils and on the porphyries on the Herberton-Irvinebank tableland, but seeks good deep soils.

"Scented Gum." "Found sparsely throughout the coastal range north of Townsville. Grows in ridgy country, tall growing with spare top, pink bark, timber grey, dark heart." Near Atherton (District Forest Inspector H. W. Mocatta).

This tree which is so very common on the east side of the coast range in New South Wales, was thought at no very distant date to be almost confined to this colony. But it changes its character, and under another name, *E. citriodora* or Lemon-scented Gum, extends right up to the waters of the Carpentaria. It is always a fine tree and loves the warm sheltered eastern slopes of the ranges. But in tropical Queensland it becomes a very much finer tree. The peculiar spotted appearance of the stem is exchanged for a uniform greyish blue tint. The tree is tall and stately, with a large sound trunk, and, in fact, there are no Eucalypts which can at all compete with it in size except *E. Raveretiana*, and its leaves now send forth a strong perfume which is most grateful at a distance and like roses, but close it is most powerful and pungent and exactly like essential oil of lemon. . . . I have tried to fix the southern limit of the *citriodora* variety. Between Maryborough and the Burnett is the first place where the peculiar smell of rose leaves becomes apparent in the open forests. Mr. C. Moore is quoted as having found it in Wide Bay. On the road between Gympie and Maryborough, or about 120 miles north of Brisbane, the spotted variety of *E. maculata* is very abundant on stony ridges. The spotted character has disappeared somewhat and the trunks of the trees have a uniform reddish hue which is very remarkable. Here, too, one notices that the trees exude great quantities of a dark brown resin that ought to be of some commercial value. The strong rose scent in the woods, which is indicative of this tree, begins about the Burrun River on the overland road between Maryborough and Bundaberg. The tree is, however, nowhere abundant, and I think

places may be found where the two varieties grow side by side on the Burnett. After this, the spotted variety disappears and the scented kinds are confined to a few stony spots of the most elevated ridges as one journeys north. The farthest north I have seen it was on the summit of the Slate Range, 2,100 feet above the sea, on Carpentarian waters, in about Lat. 16° S. It extends no great distance inland. Fifty miles from the coast is the farthest I remember to have seen it. . . . In the young state the shoots are often hispid from an abundance of coarse glandular hairs of red colour. This variety has more the odour of balm than of lemon, and hence was described as a different species. This is *E. melissiodora* Lindley, of the Flora, which was found by Mitchell and described in "Tropical Australia." The appearance for a young Eucalypt is very remarkable. The foliage is short and rough and quite rusty looking, from the glands which become bristly on the small branches. (Rev. J. E. Tenison-Woods in *Proc. Linn. Soc. N.S.W.*, vii, 338, 1882–3.)

AFFINITIES (of Species).

E. maculata is a well-defined member of the Corymbosæ, but it stands out from all of them because of its smooth, blotched bark.

With *E. Torelliana* F.v.M.

This is the nearest species to it, but it has black, scaly bark up to about 10 feet up, while *E. maculata* has practically no rough bark. Then let us turn to Plate 160, Part XXXIX, for *E. Torelliana*. It will be seen that the leaves of both species are peltate and hairy in their earliest stages, developing into the usual lanceolate-leaved form, but in *E. Torelliana* the persistence of the broad, juvenile form is greater than in *E. maculata*. The flower buds have a good deal of resemblance, but the opercula are more conoid and more sessile in *E. Torelliana*. The fruits are more urceolate and more distinctly urceolate in *E. Torelliana*, while there is an absence of the warty excrescences so often seen in the fruits of *E. maculata*.

DESCRIPTION.

CCXL. E. Mooreana (W. V. Fitzgerald) Maiden.

In *Journ. Roy. Soc. N.S.W.*, xlvii, 221 (1913).

Following is the original description :—

Arbor parva, contorta, glauca. Ramuli teretes. Folia juvenilia ovato-cordata vel lato-lanceolata, amplexicaula vel perfoliata, crassa, pleraque 10 cm. longa, 8 cm. lata. Venae patentiores, venis secundariis fere parallelibus, vena peripherica a margine remota. Folia matura ampliora et acuminatiora. Opercula conica et longitudine et diametro 1 cm. metientia. Fructus hemisphaerico-cylindroidei, valvarum apicibus conspicue exsertis.

In honour of Newton J. Moore, Minister for Lands, subsequently Premier, and then Agent-General in London for the State of Western Australia.

A small crooked tree, glaucous all over, branchlets round. Notes on bark and timber not available. (A White Gum with reddish timber; see below.)

Juvenile leaves.—Ovate-cordate or bluntly and broadly lanceolate, stem-clasping or perfoliate. Thick, somewhat undulate, uniform colour on both sides, venation somewhat spreading, the secondary veins roughly parallel. Intramarginal vein distant from the edge. Average size say 10 x 8 cm.

Mature leaves.—These do not differ essentially from the juvenile leaves, except that they are larger and more acuminate. Average size, say 15 x 9 cm.

Buds.—Four to seven on a sessile or nearly sessile head with a thick common peduncle of about 1 cm. Symmetrical, the operculum bluntly conical, about 1 cm. long and of equal diameter, the calyx-tube of equal length and with one or two angles.

Flowers.—Pale yellow when fresh, drying orange red. Anthers long and creamy in colour, opening in parallel slits, large gland at the back, filament attached to the middle, versatile.

Fruits.—Hemispherical-cylindroid, with a thin, sharp, slightly domed rim, the tips of the valves very prominently protruded. Diameter at rim scarcely 1 cm.

When Mr. Fitzgerald went to the war in April, 1916, he entrusted many of his botanical manuscripts to me, and amongst them I found the following description of *E. Mooreana*, which I reproduce here, as it usefully supplements the description I had drawn up nearly three years previously. A few notes from it I published in *Journ. Roy. Soc. N.S.W.*, li, 454 (1917).

Arborescent; branchlets, foliage and inflorescence mealy-white, seldom green, the branchlets terete or slightly angular; leaves sessile, opposite, broadly ovate, obtuse or scarcely acute, cordate or almost amplexicaul, rather rigid, veins divergent, the intramarginal one distant from the edge; flowers sessile, mostly 6–8 together, on axillary opposite peduncles which are thick, angular and dilated upwards; calyx-tube obovoid, obtusely angled, lid conical, as long as or slightly longer than the tube, tapering into a short obtuse beak, enveloped until shortly before expansion of the stamens in an outer membranous covering of the same shape; stamens all antheriferous, the outer somewhat short and flexuose, the inner

inflected in the bud ; anthers broadly oblong or almost ovate, with distinctly parallel cells dehiscing longitudinally ; ovary conical; style stout, shorter than the stamens ; fruit broadly obovate, obscurely angled, not constricted at the summit, the rim rather thick and flat; capsule scarcely sunk; valves four, deltoid and much protruding; seeds angular, the sterile ones small and narrow.

Height, 30 feet, the trunk and limbs crooked, the former 10 feet; diameter 1½ feet. Bark smooth, white and persistent. Timber reddish, tough and moderately hard. Leaves 4–6 inches long, 2½–3 inches broad. Peduncles usually ½ inch long; calyx-tube 4 lines long. Stamens about 3 lines, the filaments pale-yellow. Fruit 5 lines long, 4 lines diameter. Seeds black.

In sandy soil overlying sandstone and quartzite. Summits of Mts. Broome, Leake, Rason and Bold Bluff. (W.V.F.)

Occasionally the leaves are quite connate and the calyces concrete. Affinity—*E. pulverulenta* Sims.

RANGE.

So far as we know at present, it is confined to tropical Western Australia.

Summits of Mounts Broome, May ; Leake, July ; Rason, September, 1905 ; and Bold Bluff, all Lady Forrest and King Leopold Ranges, Kimberley, north West Australia (W. V. Fitzgerald). Collected during the Kimberley Survey Expedition.

AFFINITIES.

1. With *E. perfoliata* R.Br.

Both have thick perfoliate leaves which generally resemble each other, but those of *E. perfoliata* are longer. The flowers and inflorescence are different, while the very large fruits which belong to the section Corymbosæ, and have sunk valves, are totally different.

2. With *E. alba* Reinw.

The fruits have something in common and also the juvenile leaves, which are, however, petiolate in *E. alba*. The buds are very different. The mature leaves of *E. alba* are never so lanceolate as those of *E. Mooreana*. *E. alba* is a glabrous, soft, large Gum of moist flats, *E. Mooreana* is a crooked glaucous tree of mountain tops. (I have never seen the trees, and the above suggestions as to affinities were made as the result of examination of such herbarium material as was available to me in 1913.)

3. With *E. pulverulenta* Sims.

Mr. Fitzgerald makes this suggestion, as we have already seen. For *E. pulverulenta*, see Part XXI, p. 12, with Plates 90 and 91. *E. Mooreana* is a tree of 30 feet; *E. pulverulenta* is a tall spindly shrub. Both of them, so far as we are aware, have broad leaves in all stages, although apparently those of the latter species do not attain the size that those of the former do. The buds possess a good deal of similarity, but those of *E. pulverulenta* never exceed three in number, while those of *E. Mooreana* may have as many as eight. The valves of those of *E. Mooreana* are more exsert than those of *E. pulverulenta*, and the fruits are probably rather smaller. The geographical positions of the two species are widely different, and the absence of photographs of the tree and of specimens of bark and timber make it difficult, under the circumstances, to assess the affinities of *E. Mooreana*. Mr. Fitzgerald had such remarkable success in collecting in the Kimberleys, and describing new forms, that it is to be hoped that this area will be further botanically explored, in order to still further add to our knowledge of the affinities of the Eucalypts and other genera.

DESCRIPTION.

CCXLI. E. approximans Maiden.

In *Journ. Roy. Soc. N.S.W.*, liii, 65 (1919).

Following is the original description :—

Frutex Mallee similis 4–10 ft. altus magna multitudine crescens. Foliis teneribus lineari-lanceolatis, foliis maturis lineari-lanceolatis rectis vel leniter falcatis, acuminatis 7·5 cm.—1 dm. longis, 6–7 mm. latis, crassis, nitentibus, costa media sola conspicua, marginibus uniformiter glandulosis, glandulis oleosis dense punctatis. Pedunculis circiter ·5 cm. longis, 4–8 flores breve pedicellatos ferentibus. Alabastris clavatis, operculo hemispherico-conoideo calycis tubo dimidio aequilongo. Antheris reniformibus. Fructibus cylindroideis circiter 5 mm. diametro, capsula valde emersa.

"A Mallee-like plant of 4–10 feet growing in masses. Much resembles *E. stricta* of the Blue Mountains in its mode of growth. Stems dark grey, with patches of lighter bark. Becomes ribbony at certain periods. Generally one inch in diameter and never more than two." (J. L. Boorman.)

Juvenile leaves (seen almost but not quite opposite) linear-lanceolate, very similar to the mature leaves, the stems glandular.

Mature leaves linear-lanceolate, straight, or slightly falcate, acuminate, and often with a hooked point, 7·5 cm. to 1 dm. (say 3 to 4 inches) long, and 6–7 mm. broad, thick and shining, the midrib alone visible, the margins uniformly glandular, giving them almost the appearance of being serrulate. Uniformly and copiously dotted with oil-glands on the upper surface, the more prominent of which become black points as age proceeds.

Peduncles about ·5 cm. long, slightly angular or terete, each with 4 to 8 shortly pedicellate flowers.

Buds clavate, calyx-tube about 3 mm. in diameter, operculum hemispherical-conoid, about half the length of the calyx-tube. Stamens inflected in the bud, filaments nearly white, anthers reniform.

Fruits cylindroid or ovoid-oblong, truncate, not contracted at the orifice, about 5 mm. in diameter, the rim narrow and sloping inwards, the capsule deeply sunk.

RANGE.

Type from Barren Mountain (Henry Deane), in National Herbarium, Sydney.

Confined to the north-eastern part of New South Wales so far as we know at present. "From the summit of the Barren Mountain, on the range dividing the Bellinger and Clarence Rivers, 45 miles from the coast, and 4,500 feet above the sea." (Henry Deane, 1901.) "Grows facing a northerly aspect. This mountain is in the Dorrigo and Guy Fawkes district." (J. L. Boorman, 1913.)

AFFINITIES.

1 and 2. With *E. stricta* Sieb., and *E. apiculata* Baker and Smith.

Its closest relations are with these two species, but their fruits are always urceolate or ovoid, and not cylindroid or ovoid-oblong. The leaves are broader than those of *E. apiculata* and resemble those of *E. stricta* a good deal, but those of the present species are more copiously dotted and possess the appearance of an almost serrulate margin.

The species is referred to in Part IX, 283, under *E. stricta*. The specimen from Blackheath referred to as " B " (Maiden and Cambage) has prominent spreading, usually well-defined venation, with the fruits inclined to be barrel-shaped. This puzzling form is still under investigation, for it has affinities with other Renantheræ.

E. approximans is a member of a trio (the other two members being *E. stricta* and *E. apiculata*) that are not easy to separate. Thus the two latter can only be separated by a convention (width of suckers, a variable, like all other characters, see Part IX). The same thing may be said (perhaps quoting other characters) of other geminate species. But it seems to me that, in the important matter of fruits, those of *E. stricta* and *E. apiculata* are always urceolate, or approximate thereto. In specimen " B " the primary shape appears always to be that of a barrel, while in *E. approximans* the shape is always cylindroid. I have raised seedlings of " B," *E. apiculata* (*E. stricta* may be omitted, as less close to *E. approximans* than *E. apiculata*) and *E. approximans*. Those of " B " are for the most part with stem-clasping leaves, and have no close affinity to the last; those of *E. apiculata* and *E. approximans* present certain differences that are difficult to make clear without illustrations.

I have already shown how close the species is to the *E. stricta* series, but although I have examined the relationship over and over again since I received the plant in 1901, I have never distributed it before describing it as new, as after every careful inquiry I felt that I could not place it under a described species.

DESCRIPTION.

CCXLII. E. Stowardi Maiden.

In *Journ. Roy. Soc. N.S.W.*, li, 457 (1917).

Following is the original description :—

Mallee vocatus ad 10′ altus. Foliis maturis coriaceis, nitentibus, lanceolatis, paullo falcatis, ca. 11 cm. longis, 3 cm. latis maxima latitudine, longis petiolis 2–3 cm. Floribus teretibus pedunculis, pedicellis ad 5 cm. Alabastris magnis, clavatis, calyce tubo operculo minus dimidio aequante, ca. 1·5 cm. longo, 5-costis prominentibus in pedicellem angustatis, costis operculi longi paullo angustati obtusi numerosioribus minore profundis. Fructibus magnis conoideis, 3–5 costis prominentibus, margine. truncata planata lata, orificio parvo.

" A shrubby Mallee " with smooth bark.

Juvenile leaves not seen in their earliest stages, but broader, and with the intramarginal vein more remote from the edge than in the mature ones.

Mature leaves coriaceous, shining, of similar colour on both sides, covered with fine black dots, with long petioles (say 2–3 cm.) lanceolate, asymmetrical, slightly falcate, tapering gradually to an apex consisting of a soft point, about 11 cm. (say 4½ inches) long and 3 cm. broad in its widest part.

Flowers with a terete peduncle of 2 2·5 cm., about seven in the head, with flattened pedicels up to ·5 cm. The buds large, clavate, the calyx-tube longer than a third of the operculum, about 1·5 cm. long, with five prominent ribs tapering into the pedicel, the long slightly tapering blunt operculum with more numerous, shallower ribs than those of the calyx-tube.

Filaments cream-coloured, sometimes with a purplish flush at the base, tapering trigonous or tetragonous, ribbed, with numerous glands, anthers large with parallel cells and large gland at back.

Fruits conoid, with three to five more prominent ribs and a number of intermediate shallower ones, with a truncate, flattish, slightly rounded, broad rim, with a small orifice; tips of the valves sunk or scarcely flush with the orifice.

Kwelkan, on the Northam-Merriden line, a few miles north of Kellerberrin, Western Australia. (Dr. Frederick Stoward, Government Botanist and Plant Pathologist, No. 150, April, May, 1917.) The type.

The material is scanty and it would appear that the following specimen also belongs to this species As this material is also sparse, it is desirable to describe it :—

A shrub or " small tree, the highest I have seen does not exceed 10 feet." Bark of a smooth, dull grey. Branchlets round, more or less glaucous, as also the petioles, young leaves and fruits, the whole plant perhaps largely glaucous at certain seasons.

Juvenile leaves not seen.

Mature leaves very thick, coriaceous, dull to shiny, of an olive green, and the same colour on both sides, lanceolate to ovate, petiolate, the base ending rather abruptly in a petiole of 2 cm., the lanceolate leaves mostly tapering into a fine point, about 10 cm. (4 inches) long, or shorter, and about 2·5 cm. (1½ inch) broad, both surfaces entirely covered with innumerable fine black dots, the midrib and secondary veins moderately prominent, the secondary veins spreading and roughly parallel, making an angle of about 45° with the midrib, the intramarginal vein distinctly removed from the edge.

Buds cylindroid, the blunt cylindrical operculum about twice as long as the slightly ribbed calyx-tube, about five to eight in the umbel, on a decurved peduncle of 2·5 cm., each calyx-tube gradually tapering into a pedicel of under 1 cm.

Flowers.—" The bloom is evidently a large pale yellow " (Vachell). Anthers large, with parallel cells and large gland at back.

Fruits moderately large, conoid, flat-topped, rather gradually tapering into a flattish pedicel, with two especially prominent longitudinal ribs or wings running from the rim and causing an expansion of the pedicel, together with a number of less prominent ribs of which two are only secondary to the main ones, rim moderately broad and flat, with four deltoid or acicular tips of the valves distinctly protruding beyond the orifice and encased with the whitish remains of the capsule-lining.

" Baronrath," *via* Kellerberrin, W.A. Flowers and ripe fruit, September, 1903; nearly ripe fruit, December, 1903 (F. Harvey Vachell).

" Grows on the sand-plains about here. I have only met with a small group of them."

RANGE.

This species is only known from Western Australia. The localities already indicated are Kwelkan and Kellerberrin. A third locality is Uberin Hill, Dowerin (from Mr. C. A. Fauntleroy, through Mr. W. C. Grasby), in the same general area.

AFFINITIES.

1. With *E. erythronema* Turcz.

See Plate 93, Part XXII of the present work. The leaves of *E. erythronema* are narrower, the pedicels longer, the calyx-tubes not ribbed, the filaments pale and not glandular, the opercula conical, the fruits smaller, more flat-topped and less constricted at the orifice. The anthers are not dissimilar, and it would appear that *E. Stowardi* and *E. erythronema* are closely allied.

2. With *E. Forrestiana* Diels.

See Plate 95, Part XXII of the present work. In *E. Forrestiana* the peduncle is longer, the pedicels more articulate, the anthers more rounded, the filaments less grooved, though glandular. The opercula shorter, more conoid and less in diameter than the calyx-tube. The fruits larger and more quadrangular, the ridges more pronounced.

3. With *E. incrassata* Labill., var. *angulosa*.

Compare Plate 14, Part IV of the present work. The foliage of var. *angulosa* is coarser, the peduncle strap-shaped, the operculum shorter, and it and the fruit more corrugate.

4. With *E. Pimpiniana* Maiden.

See Plate 72, Part XVI of the present work. Attention may be drawn to the imperfectly known *E. Pimpiniana* to which it is also related, but less closely so. The fruits of *E. Pimpiniana* are more ovoid and less ribbed.

5. With *E. occidentalis* Endl.

It appears to be closest allied to this species, but the peduncle is flat in *E. occidentalis* and terete in *E. Stowardi*. In some forms of *E. occidentalis* we have also glandular filaments. The buds of *E. occidentalis* are more terete, *i.e.*, less ribbed; the fruits more urceolate and the valves more exsert, with a much thinner rim.

Since the above was written I received the excellent specimens from Mr. Fauntleroy (referred to at *Journ. Roy. Soc. N.S.W.*, lii, 510 (1918), which enable me to clear up all doubts as to the affinities of the species.

I surmised that its closest affinity was *E. occidentalis* Endl., and these specimens leave no doubt on the point. They have the angular filaments seen in that and allied species, and peculiar, I believe, to the Cornutæ. Mr. Fauntleroy also supplies a small log, which is quite smooth, with long, thin, tough ribbons, and barely 2 inches in diameter for the most part, though where it is swollen, as the result of the boring of an insect, it is more than 3 inches. The colour of the small timber is white, varying to pale brown in the centre.

Explanation of Plates (176–179).

PLATE 176.

E. calophylla R.Br.

1*a*. Juvenile leaf in the earliest stage, scabrous, peltate, secondary veins curved. These juvenile leaves vary in size; 1*b*, intermediate leaf, the feather veins approaching those of the normal leaves. Both from Bow River, south West Australia. (Sid. W. Jackson, presented by H. L. White.)

2. Young buds, showing bracteoles. Deep River, south West Australia. (Sid. W. Jackson, presented by H. L. White.)

3*a*. Mature leaf; 3*b*, buds; 3*c*, anthers; 3*d*, unripe fruit, drying irregularly; the urceolate and the bullate appearance are alike exaggerated. Perth district. (Dr. F. Stoward.)

4. Fruit. Albany. (Henry Deane.) A stunted specimen, taking on a globular appearance, and with orifice somewhat contracted.

5. Normal fruit, contracted a little in drying, but fairly characteristic of the species. Lower Canning River, Perth district. (Dr. A. Morrison.)

E. ficifolia F.v.M. (See also Plate 177.)

6*a*. Mature leaf (small); 6*b*, buds and flowers (note the persistent operculum); 6*c*, front and back view of anther. Shannon River, south West Australia. (W. V. Fitzgerald.)

7 Young buds, showing bracteoles. Cultivated, Botanic Gardens, Sydney. (W. F. Blakely.)

PLATE 177.

E. ficifolia F.v.M. (See also Plate 176.)

1. Mature leaf. The leaves vary a good deal in width and size.
2. Mature fruit. Near Wilson's Inlet, south West Australia. (W. V. Fitzgerald).
3. Not quite mature fruit, showing an urceolate shape. Irwin's Inlet, south West Australia. (S. W. Jackson, presented by H. L. White.)

E. hæmatoxylon Maiden.

4. Juvenile leaf, not quite in the earliest stage. "Mountain Gum." (Department of Woods and Forests, Perth, W.A., 1914. Probably from Jarrahwood, W.A.)
5. Intermediate leaf; cultivated, Botanic Gardens, Sydney. (W. F. Blakely.)

6*a*. Small intermediate leaf; 6*b*, mature leaf; 6*c*, nearly fully expanded buds; 6*d*, front and back view of anther; 6*e*, nearly ripe fruit, dotted all over. Jarrahwood, south West Australia. (Forest Ranger Donovan.)

7*a*. Mature leaf; 7*b*, calyx-tubes just after the fall of the stamens; 7*c*, ripe fruits. Happy Valley. (Forest Ranger Donovan.)

PLATE 178.

E. maculata Hook.

1*a*, 1*b*. Juvenile leaves in the earliest stage, scabrous and peltate. Brisbane, Queensland. (J.H.M.)

2*a*. Large mature leaf; 2*b*, unexpanded buds, still enclosed in double opercula; 2*c*, coarse, warty old fruits. Enoggera, near Brisbane. (J. L. Boorman.)

3. Small, non-urceolate fruits. Milton, N.S.W. (J. L. Boorman.)

4*a*. Buds, showing outer and inner opercula; 4*b*, back and front view of anthers; 4*c*, fruits. Near Liverpool, N.S.W. (J.H.M.)

E. maculata var. *citriodora* F.v.M.

5. Juvenile leaf in the earliest stage, scabrous and peltate and very aromatic. Duaringa, 65 miles west of Rockhampton, Queensland. (J.H.M.)
6. Juvenile leaf in the earliest stage. Type of *E. melissiodora* Lindl., collected by Sir Thomas Mitchell at Balmy Creek. (See p. 91.)

7*a*. Mature leaf (from top of tree); 7*b*, buds; 7*c*, front and back view of anthers; 7*d*, ripe fruit, warted. Stannary Hills, North Queensland. (Dr. T. L. Bancroft.)

PLATE 179.

E. Mooreana (W. V. Fitzgerald) Maiden.

1*a*. Juvenile leaf; 1*b*, umbel of buds included in double operculum; 1*c*, mature leaf, with ripe buds and an expanded flower; 1*d*, views of anther; 1*e*, mature fruits. 1*a* and 1*b*, summit of Mount Broome; 1*c*, 1*d*, and 1*e*, summit of Mount Rason, King Leopold Range, Kimberleys, north Western Australia. (W. V. Fitzgerald.) The type.

E. approximans Maiden.

2*a*. Mature leaves; 2*b*, portion of a leaf, enlarged, showing the sinuate, translucent margin, and the abundance of oil-glands; 2*c*, unripe buds; 2*d*, front and back view of anther; 2*e*, fruits. Barren Mountain, north-eastern New South Wales. (Henry Deane.) The type.

E. Stowardi Maiden.

3*a*. Juvenile leaf, though not quite in the earliest stage; 3*b*, mature leaf, with flower and also calyx-tube with persistent style; 3*c*, buds; 3*d*, front and back views of anthers, with angular and glandular filaments; 3*e*, different views of fruit. Kwelkan, Western Australia. (Dr. F. Stoward.) The type.

4*a*. Smaller buds and flowers; 4*b*, front and back view of anthers; 4*c*, fruits, smaller than those of the type. Kellerberrin, W.A. (F. H. Vachell.)

The following species of Eucalyptus are illustrated in my "Forest Flora of New South Wales"* with larger twigs than is possible in the present work; photographs of the trees are also introduced wherever possible. Details in regard to their economic value, &c., are given at length in that work, which is a popular one. The number of the Part of the Forest Flora is given in brackets :—

acacioides A. Cunn. (xlviii).
acmenioides Schauer (xxxii).
affinis Deane and Maiden (lvi).
amygdalina Labill. (xvi).
Andrewsi Maiden (xxi).
Baileyana F.v.M. (xxxv).
Baueriana Schauer (lvii).
Baueriana Schauer var. *conica* Maiden (lviii).
Behriana F.v.M. (xlvi).
bicolor A. Cunn. (xliv).
Boormani Deane and Maiden (xlv).
Bosistoana F.v.M. (xliii).
Caleyi Maiden (lv).
capitellata Sm. (xxviii).
conica Deane and Maiden (lviii).
Consideniana Maiden (xxxvi).
coriacea A. Cunn. (xv).
corymbosa Sm. (xii).
crebra F.v.M. (liii).
dives Schauer (xix).
eugenioides Sieb. (xix).
fruticetorum F.v.M. (xlii).
gigantea Hook. f. (li).
goniocalyx F.v.M. (v).
hæmastoma Sm. (xxxvii).
hemiphloia F.v.M. (vi).
longifolia Link and Otto (ii).
Luehmanniana F.v.M. (xxvi) (=*E. virgata*).
macrorrhyncha F.v.M. (xxvii).
maculata Hook. (vii).
melanophloia F.v.M. (liv).
melliodora A. Cunn. (ix).
microcorys F.v.M. (xxxviii).
microtheca F.v.M. (lii).
Muelleriana Howitt (xxx).
numerosa Maiden (xvii).
obliqua L'Hérit. (xxii).
ochrophloia F.v.M. (l).
odorata Behr and Schlechtendal (xli).
oleosa F.v.M. (lx).
paniculata Sm. (viii).
pilularis Sm. (xxxi).
piperita Sm. (xxxiii).
Planchoniana F.v.M. (xxiv).
polyanthemos Schauer (lix).
populifolia Hook. (xlvii).
propinqua Deane and Maiden (lxi).
punctata DC. (x).
radiata Sieb., as *E. amygdalina* (xvi).
regnans F.v.M. (xviii).
resinifera Sm. (iii).
rostrata Schlecht. (lxii).
rubida Deane and Maiden (lxiii).
saligna Sm. (iv).
siderophloia Benth. (xxxix).
sideroxylon A. Cunn. (xiii).
Sieberiana F.v.M. (xxxiv).
stellulata Sieb. (xiv).
tereticornis Sm. (xi).
Thozetiana F.v.M. (xlix).
virgata Sieb. (xxv).
vitrea R. T. Baker (xxiii).

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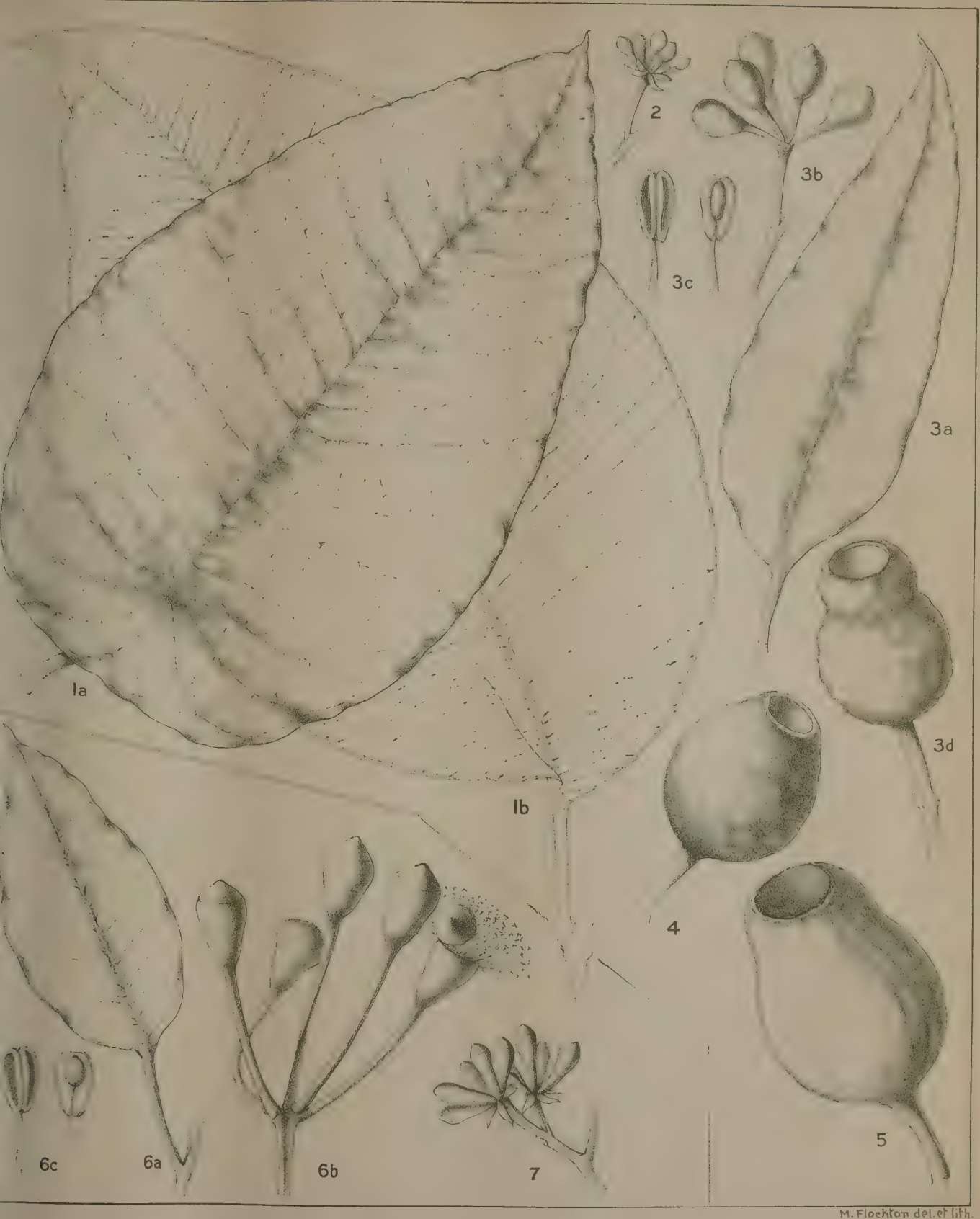
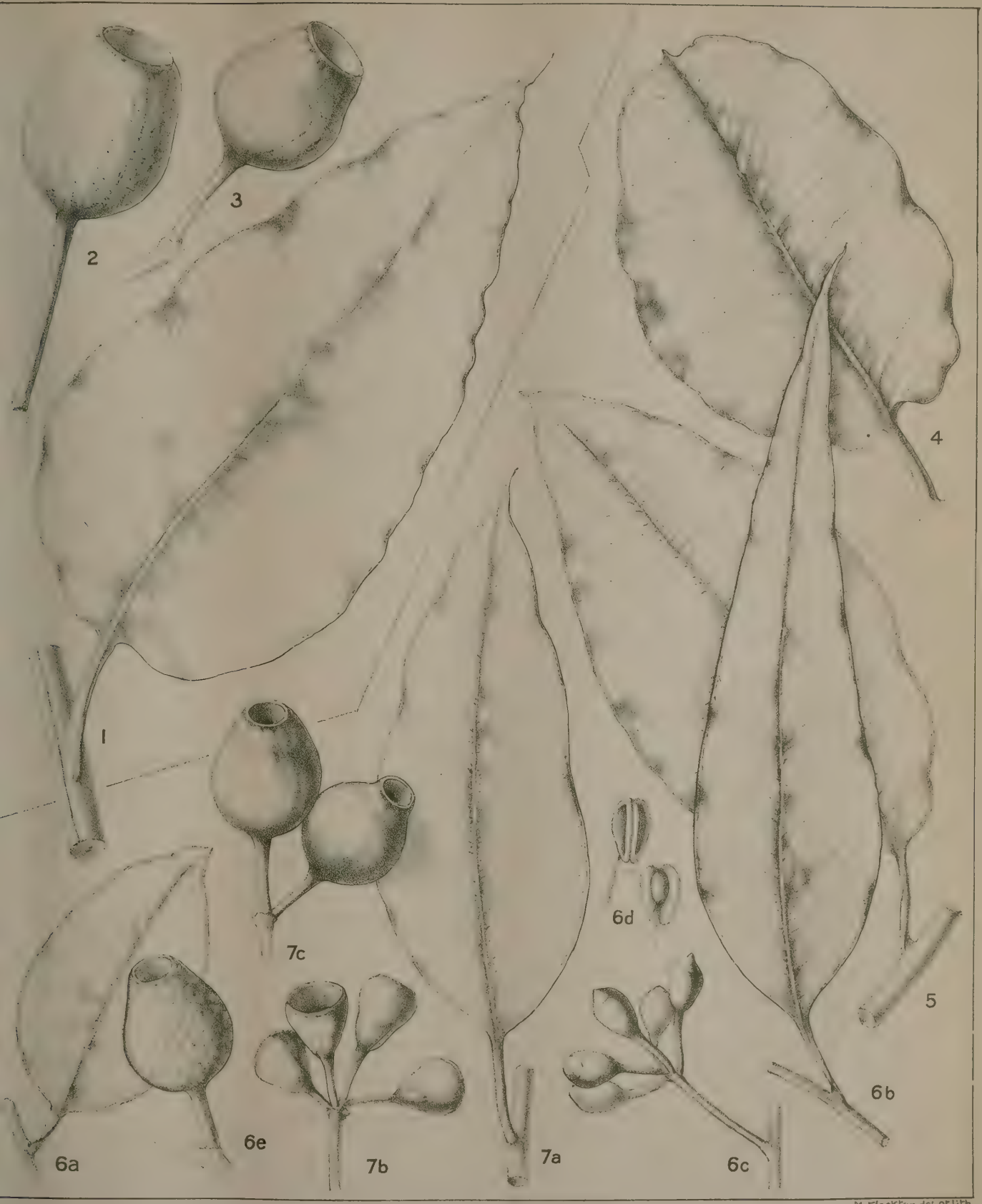
* Government Printer, Sydney. 4to. Price 1s. per part (10s. per 12 parts); each part containing 4 plates and other illustrations.

Sydney: William Applegate Gullick, Government Printer.—1908



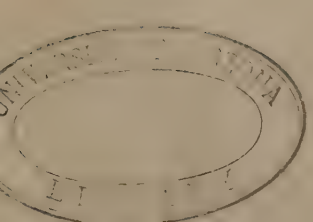
EUCALYPTUS CALOPHYLLA R.BR. (*1-5*)

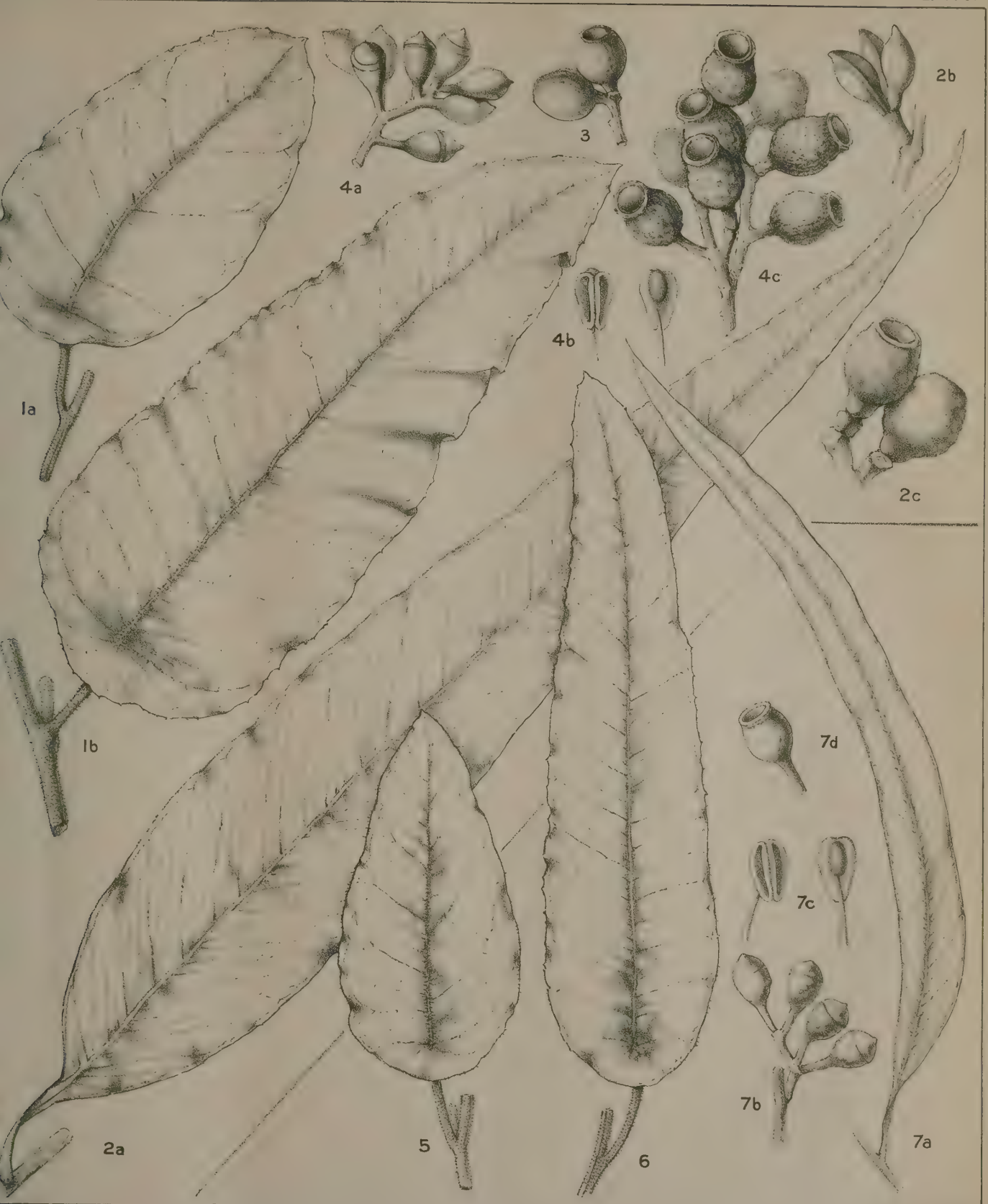
E. FICIFOLIA F.v.M. (*6, 7*) [See also Plate 177.]



EUCALYPTUS FICIFOLIA F.v.M. (*1–3*) [See also Plate 176.]

E. HÆMATOXYLON MAIDEN. (*4–7*)





EUCALYPTUS MACULATA Hook. (*1–4*)

E. MACULATA *var.* CITRIODORA F.v.M. (*5–7*)

M. Flockton. del. et lith.

EUCALYPTUS MOOREANA (W. V. FITZGERALD) MAIDEN. (*1*)

E. APPROXIMANS MAIDEN. (*2*) E. STOWARDI MAIDEN. (*3, 4*)

A Critical Revision of the genus Eucalyptus

BY

J. H. MAIDEN, I.S.O., F.R.S., F.L.S.

(Government Botanist of New South Wales and Director of the Botanic Gardens, Sydney).

Vol. V. Part 4.

Part XLIV of the Complete Work.

(WITH FOUR PLATES.)

"Ages are spent in collecting materials, ages more in separating and combining them. Even when a system has been formed, there is still something to add, to alter, or to reject. Every generation enjoys the use of a vast hoard bequeathed to it by antiquity, and transmits that hoard, augmented by fresh acquisitions, to future ages. In these pursuits, therefore, the first speculators lie under great disadvantages, and even when they fail, are entitled to praise."

MACAULAY'S "ESSAY ON MILTON."

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DESCRIPTION.

CCXLIII. E. perfoliata R. Brown.

In Bentham's "Flora Australiensis," iii, 253 (1866).

FOLLOWING is the original description :—

A large shrub of 10 feet or more (*A. Cunningham*). *Leaves* opposite, connate, 6 to 8 inches long and 3 to 4 inches broad, very obtuse, glaucous, with numerous parallel transverse veins. *Flowers* large, sessile in heads of four to six, on terete peduncles, forming a corymbose terminal panicle. *Calyx-tube* thick, broadly turbinate, smooth or nearly so, 7 to 8 lines long and as much in diameter. *Operculum* not seen. *Stamens* above ½ inch long, inflected in the bud; anthers small, ovate-oblong, with parallel distinct cells. *Fruit* urceolate, 1½ inch long and above 1 inch diameter, smooth, the rim concave, the capsule sunk. *Seeds* not seen.

It will be observed from the figures that the operculum is shorter than the calyx-tube; it is slightly conoid, but the process of drying accentuates its pointed character.

The anthers are certainly small (see fig. 2*c*, Plate 180) for a member of the Corymbosæ, and will be drawn attention to when anthers are treated of collectively, and also when the affinities of the Corymbosæ are dealt with.

W. V. Fitzgerald (MSS.) adds the following information :—

Tree from 20–40 feet; trunk, very crooked and frequently piped, to 15 feet, diameter 1 foot; bark persistent on stem and branches, dark-grey, rough, lamellar, and longitudinally fissured; timber very dark-red, tough and hard; filaments white to pale yellow; fertile seeds terminating in a long membranous appendage.

If Mr. Fitzgerald has made no mistake in his notes, it will be observed that the species attains the height of a medium-sized tree.

RANGE.

It is confined to Western Australia (the tropical north-west) so far as we know at present.

Bentham (original description) quotes it from "Barren Hills, Rae's River (should be Roe's), North West Coast, *A. Cunningham.*" On the specimen in the Kew Herbarium are the following notes: "Metrosideros, Roe's River, A. Cunningham," and "Roe's River, 238/1820, Sept., N.-W. Australia," A. Cunningham, which means that it was collected on Captain P. P. King's Expedition, and that it was specimen No. 238, collected in September, 1820.

Roe's River runs into York Sound, and must not be confused with a river of similar name in the Northern Territory.

Bentham also records it from Surgeon Bynoe (Captain J. Lort Stokes' Expedition, 1838).

WESTERN AUSTRALIA.

I have seen the following north-west specimens :—

Leaves only (Harry Stockdale).

King's Sound, fruits and a leaf (W. W. Froggatt, seen by Mueller).

Leaves, buds, and fruits. Lennard River (W. V. Fitzgerald, No. 333).

Native Well, 9 miles from Goody Goody, near Derby. (W. V. Fitzgerald, No. 333 bis.)

Six miles north-east of Mt. Eliza. (W. V. Fitzgerald, No. 707).

Mt. Anderson and Grant Range. (W. V. Fitzgerald).

Balmarringarra, not far from coast; Exmouth to King's Sound. (Dr. H. Basedow.)

AFFINITIES.

E. perfoliata, as a member of the Corymbosæ, stands in a class by itself, because of its connate leaves and small anthers.

If fruits alone are available for comparison, they may be compared with those of *E. terminalis* (Plate 164, Part XL); *E. pyrophora* (Plate 166, Part XL); *E. Foelscheana* (Plate 169, Part XLI); *E. Abergiana* (Plate 170, Part XLI). If buds are alone available, they are most likely to be confused with those of *E. pyrophora*.

1. With *E. gamophylla* F.v.M.

"The concrescence of the leaves by pairs in all stages of growth occurs, so far as known, only in *E. perfoliata*, if even in that rare and little known congener this coalescence should prove also unexceptional. . . ." ("Eucalyptographia," under *E. gamophylla*.)

A discussion on such leaves will be found at pages 53 to 55 of Part XLII of the present work. The number of species originally believed only to have connate leaves during all stages of growth has been gradually reduced, until, apparently, *E. perfoliata* alone remains, although in some, where a petiole has been found, it is exceedingly short. As regards *E. gamophylla*, see Plate 147, Part XXXV of the present work, it would appear to differ from *E. perfoliata* in almost every other character.

DESCRIPTION.

CCXLIV. E. ptychocarpa F.v.M.

In *Journ. Linn. Soc.* iii, 90, (1859).

Following is a translation of the original :—

A tree, with angular branchlets, leaves large, thick, alternate, obliquely lanceolate, drawn out to a point, moderately petiolate, rather shining on the upper side, paler beneath, penniveined, marginate, imperforate, peripheral vein close to the margin, umbels terminal, paniculate, few to seven-flowered, partial peduncles two or three times longer than the angled pedicels, calyx markedly 8-ribbed, operculum hemispherical, two or three times shorter than the tube. Capsules large, ovate-campanulate, deeply 8-ribbed, 4-celled, valves deeply included, fertile seeds with long wings on the upper side.

On woody creeks and on drying watercourses, near the sources of the Rivers Wentworth, Wickham, and Limmen Bight. Flowering in March and April.

A medium-sized or large tree with a dirty, greyish, wrinkled bark, somewhat fibrous within and everywhere persistent. Leaves 5–7 inches long, 1½–2 inches broad. Capsule 1–1½ inches long, contracted a little at the orifice, valves short. Seeds 2 lines long—that is, the fertile ones—bearing a membranous obovate wing 3 lines long, the numerous sterile ones smaller, and with narrow wings.

The trunk in the structure of the bark holds an intermediate place between the Stringybarks and Boxes.

Bentham (B. Fl. iii, 255) described it as follows :—

A middle-sized or tall tree, with a persistent bark, intermediate between that of the Stringybarks and the Box trees (F. Mueller). *Leaves* large, from broadly ovate to ovate-lanceolate, sometimes above a foot long, straight or falcate, with numerous fine, closely parallel, almost transverse veins. *Flowers* large, in umbels forming a terminal panicle, peduncles terete, ½ to 2 inches long, pedicels sometimes very short, sometimes 1 to 2 inches long. *Calyx-tube* turbinate, ½ to ¾ inch long, hard, with about 8 longitudinal ribs. *Operculum* not seen. *Stamens* above ½ inch long; filaments rigid, inflected in the bud; anthers small, ovate, with distinct parallel cells. *Fruits* ovoid or slightly urceolate, very thick and hard, 1 to 2 inches long, with about 8 prominent ribs, the rim thick, the capsule sunk. *Seeds* winged.

It is also figured in " Eucalyptographia."

For notes on the bark, see p. 107.

Colour of filaments.—Leichhardt has a note (Paris Herbarium) on a Port Essington specimen, " Scarlet blossoms," but he may have written the wrong colour in his imperfect English.

Mr. B. Gulliver, who saw the tree during Captain Cadell's voyage to Arnhem's Land, states the flowers (filaments) to be " scarlet " (" Eucalyptographia.") Mueller is, however, in some doubt, for he goes on to say, " If really they persist in the bright colour of *E. miniata* and *E. phœnicea*," &c. (I have shown under *E. ficifolia* that Mueller confused scarlet and crimson.)

W. V. Fitzgerald says (MSS.): "Filaments white or occasionally tinged with pink, and not scarlet (*vide* "Eucalyptographia")."

G. F. Hill's specimens confirm Fitzgerald's remarks. His filaments are cream-coloured and crimson. C. E. F. Allen later recorded "crimson." It is obvious that we have here a confusion between scarlet and crimson, as is not infrequently the case. The colour, other than cream, is pink to crimson.

RANGE.

North Western Australia and Northern Territory.—Mueller (original description) found it in "Dry river beds and rocky streams at the sources of the Wentworth, Wickham, and Limmen Bight Rivers."

Bentham adds, Melville Island, *Fraser.* (Fraser was never there, although specimens may have passed through his hands.) Port Essington, *Gilbert.*

Later on Mueller recorded it from a number of localities in North Western Australia, so that we have it for the most northerly portion of Australia, as far east as the Gulf of Carpentaria.

Western Australia.

The following record was made by Joseph Bradshaw's Expedition to the Regent's River, William Tucker Allen being botanical collector. "Welcome Creek, Roe's and Drysdale Rivers, chiefly on the banks of tributaries." Mueller in *Proc. Linn. Soc. N.S.W.*, xvi, 469 (1891).

Then W. V. Fitzgerald noted, from his own collection in the Kimberley district, "Isdell and Charnley Rivers; Woollybutt and Synnott Creeks," adding that it is always found in wet, boggy spots. On another occasion he says "chiefly growing along the banks of water-courses, but occasionally in rocky localities." His Woollybutt Creek specimen, near Phillips' Range, is No. 950.

Northern Territory.

Liverpool River (Gulliver in Herb. Melb.). Has a large lanceolate leaf.

"Bark like *E. terminalis* to topmost branches (*i.e.*, like a Bloodwood, J.H.M.). Trunk 15 inches diameter. Spreading, somewhat stunted growth, 28 feet high; only one tree seen." Side of small ravine, Bathurst Island (G. F. Hill, No. 467).

Bud collected by Leichhardt on his Overland Journey to Port Essington (Herb. Paris).

"Large tree, crimson flowers." Pine Creek (C. E. F. Allen, No. 116).

Powell's Creek (Prof. W. Baldwin Spencer).

" 8 Mile Spring on to Tanumbirini (near creeks and springs). Crimson filaments. Stem like Bloodwood. (Appears to be same species as white-flowering form No. 810.) " (G. F. Hill, No. 809.)"

" No. 810. 8 Mile Creek on to Tanumbirini (tree similar to 809). Cream flowers. (G. F. Hill.)

Both were collected on the same day, 26th March, 1912, and are identical, except in regard to the colour of the filaments. *E. ptychocarpa* is therefore to be added to the list of species with filaments of two colours.

AFFINITIES.

1. *With* ***E. miniata*** A. Cunn.

In the original description, Mueller says that the trunk of *E. ptychocarpa*, so far as the bark is concerned, holds an intermediate place between the Stringy-barks and the Boxes. He amplifies this in the following passage :—

" With a greyish, wrinkled, everywhere persistent, somewhat fibrous bark, thus fluctuating between the Stringybark and so-called Box trees, though in cortical characters perhaps nearest to *E. hemiphloia* and *E. albens*, but . . . . . " (" Eucalyptographia.") In his classification of barks he puts it with the Pachyphloiæ.

Mr. W. V. Fitzgerald (MSS.) says it is " a tree up to 40 feet, trunk 15 feet, diameter 2 feet, bark persistent on stem and branches, dark-coloured, rough, soft and flaky, timber red, soft and very porous." On the evidence it is not proper to put *E. ptychocarpa* with the Pachyphloiæ (Stringybarks).

It is difficult, in exceptional cases, to describe clearly the bark of a Eucalypt. That of *E. miniata* I have tried to describe at p. 37, Part XXII. While I do not say that it is the same as that of *E. ptychocarpa* (a bark I have not seen, except in a very young tree), the fact that *E. miniata* is sometimes called (with others) " Woollybutt " and " Stringybark " shows that, at least as regards the barks of the trunks of mature trees, the two species have some resemblance to each other.

A character hitherto unrecorded is that some of the young or intermediate leaves are slightly peltate. This is consistent with the suggested Corymbosæ affinity.

Bentham says: " The fruit (of *E. ptychocarpa*) somewhat resembles that of *E. miniata*, but the venation of the leaves and the inflorescence are quite different." (B. Fl. iii, 255.)

Mueller, later, observes : " From *E. miniata* it is far more distant (than *E. Abergiana*) in its not scaly-friable bark, which does not separate from the main branches, in the leaves being not of a pale and dull-green on both sides, besides of thicker consistence, much larger and proportionately also broader, without any translucent oil-dots, in the absence of stomata on the upper page of the leaves; further, in the umbels not solitary nor lateral nor axillary, in larger flowers and conspicuous development of flower-stalklets, in fruits often smaller (although similarly shaped and ridged), and in the seeds provided with a long appendage (those of *E. miniata* being quite exappendiculate). (" Eucalyptographia," under *E. ptychocarpa*.)

E. ptychocarpa is a species with ribbed fruits, the fruits being large individually. Such a species is also *E. miniata* A. Cunn.; see Plate 96, Part XXII. Those of *E. miniata* are sessile, often more elongate and narrow, sometimes hardly constricted at the orifice, but in other cases more constricted than in *E. ptychocarpa*, and with the ribs thicker. They differ also in the much smaller leaves of *E. miniata* and in the venation of them, but I know of no closer affinity for *E. ptychocarpa*.

2. With *E. Abergiana* F.v.M.

"Its affinity is with *E. Abergiana* and *E. miniata*; from the former it can be distinguished by its longer leaves, with a still paler lower page, by its also still larger flowers, which are provided with usually long stalklets (although Bentham describes the latter as occasionally also very short), and most particularly by the fruit longitudinally traversed by about eight narrow ridges." ("Eucalyptographia," under *E. ptychocarpa*.)

For *E. Abergiana*, see Plate 170, Part XLI, when it will be seen that the two species are not very closely related.

3. With *E. Forrestiana* Diels.

This is a ribbed, large-fruited species, but the fruits are only four-ribbed, while there are other differences (see Plate 95, Part XXII) which show that it is more removed from *E. ptychocarpa* than is *E. miniata*.

4. With *E. Planchoniana* F.v.M.

Although *E. Planchoniana* has been referred to in Part IX, I have not figured it, since Mueller had figured it in "Eucalyptographia," and I had nothing of importance to add. I have, however, figured it in Plate 90, Part XXIV of my "Forest Flora of New South Wales," to which I beg to refer my readers. It will be see that *E. Planchoniana* is a large-fruited species, with some ribbing of the buds and fruits, more marked in my plate than in Mueller's. *E. Planchoniana* is an Eastern Australian tree, whose affinities are not close to those of *E. ptychocarpa*.

DESCRIPTION.

CCXLV. E. similis Maiden.

In *Proc. Roy. Soc. N.S.W.*, xlvii, 90, (1913).

FOLLOWING is the original description :—

Arbor mediocris. Folia juvena tenua, glabra, pedunculata, ovato-acuminata. Folia matura angusto-lanceolata, flavo-virentia, concoloria, circiter 12 cm. longa, 2 cm. lata. Venae laterales, pinnatae distinctae, vena peripherica distincta et a margine remota. Umbellae confertae, multiflorae, plerumque in panicula terminale corymbosaque. Calycis tubus irregulariter costatus. Operculum hemisphæricum vel umbonatum. Fructus vix 1 cm. longi, truncato-ovoidei, in orificium sensim contracti.

A tree of medium size; notes on bark and timber uncertain.

Juvenile foliage.—Thin, parchment-like, perfectly glabrous, not seen strictly opposite, pedunculate, ovate-acuminate. Size of a specimen, 6 by 3 cm.

Mature foliage.—Narrow-lanceolate or slightly falcate, petiolate, the petioles flattened and twisted, length of blade up to 12 cm. and more, with a greatest width of about 2 cm. Equally yellowish-green on both sides, rather shiny, venation distinct, and nearly as prominent on the upper as on the lower side. Midrib very prominent, lateral veins pinnate and very distinct, the intramarginal vein distinct and removed from the edge.

Buds and Flowers.—Inflorescence profuse, in a loose umbel, several-flowered, mostly in a terminal corymbose panicle, the peduncles slightly compressed or angular, calyx-tube irregularly ribbed, shiny; opercula hemispherical or umbonate, shiny. Filaments yellow, anthers with long, narrow adnate cells, with a moderately large gland at the back, and the filament attached half-way up.

Fruits.—Sharply separated from the short pedicel, on a slightly flattened common peduncle of about 1·5 cm. Truncate-ovoid, gradually constricted towards the orifice, barely 1 cm. long and about 6 mm. at the orifice. Three-valved, the valves blunt, and these capsule teeth not adherent to the calyx-tube.

(In the above description two errors have crept in. The intramarginal vein is not removed from the edge, or, at most, only occasionally, and then only to a brief distance. The description of the calyx-tube as "irregularly ribbed" is a slip of the pen. The words should have been applied to the fruits. See figure 3*c*, Plate 182.)

The seeds are not winged.

RANGE.

It is confined to rather dry country in Central Queensland, so far as we know at present. The type came from "Desert country west of Emerald," so described by Mr. G. H. Carr, Crown Lands Agent, Clermont, through Mr. R. Simmonds (March, 1908).

Many years previously I had received it from Jericho (Henry Deane), with fruits larger and more elongated than those of the type.

I have received it since from Mr. W. Pagan (through Mr. C. T. White) from the vicinity of Alice, a railway station 328 miles west of Rockhampton, or 21 miles west of Jericho, at no great distance from the type locality. Publication of the drawings will enable our friends in Queensland to greatly extend its range, since there is no doubt that it has been confused in the past with other Yellow-barked Bloodwoods or Yellow Jackets.

Dr. H. I. Jensen calls it "Desert sandstone Yellow Jacket," and describes it as between a Bloodwood and Stringybark, with a very yellow bark.

AFFINITIES.

Its closest affinity (at the time of description), appeared to be *E. Baileyana* F.v.M. (See description amended by me in "Forest Flora of New South Wales," Part XXXV, 71). Like that species, it is a member of the section Eudesmieæ, and appears to differ from *E. Baileyana* in the following characters:—

1. *E. similis* is a "Yellow Gum," "Yellow Jack" or "Yellow Jacket," while *E. Baileyana* is a "Black Stringybark."

2. The mature leaves of *E. similis* have the same colour on both sides, and have shorter peduncles, while the juvenile leaves are glabrous, those of *E. Baileyana* being covered with stellate hairs.

3. The fruits of *E. similis* are, in comparison with those of *E. Baileyana*, almost spherical to cylindroid, those of *E. Baileyana* being almost spherical, darker, and much larger.

The specific name is given in view of the affinity of this species to *E. Baileyana* F.v.M. (Original description, slightly amended.)

Its relations to the other members of the Eudesmiæ will be further referred to in Part XLV when the Eudesmiæ are all figured. See also under *E. lirata*, p. 111.

DESCRIPTION.

CCXLVI. E. lirata (W. V. Fitzgerald) Maiden n.sp.

ARBOR ca. 30 m. alta, caulis diametro, 1 ad 1·5 m.; cortice aspera, cinerea sed molle et fere friable in trunco ramisque persistente, ligno brunneo; foliis ali quando oppositis, 8-10 cm. longis, petiolatis, flores, non vidi fructibus 3–5, breviter pedicellatis, ovoideo-oblongis, orificio paullo contractis; marginibus tenuibus capsulis depressis.

Arborescent; branchlets cylindrical; leaves opposite, subopposite, or alternate, lanceolate, straight or falcate, acuminate, petiolate, dull-greyish on both pages, oil-dots crowded, veins inconspicuous, ascending, the intramarginal one not far removed from the edge; fruits 3–5 together, shortly pedicellate, on terete lateral or axillary solitary peduncles, ovoid-oblong, obscurely contracted between the summits, the rims thin; capsule sunk; valves 3, somewhat triangular, semi-exserted; fertile seeds ovate, slightly compressed, dark-brown, punctate, the sterile ones very much smaller, narrow, and angular.

Height, 30–40 feet; trunk to 15 feet, diameter 1–1½ feet. Bark rough and greyish, but soft and almost friable, resembling that of some forms of *E. amygdalina* Labill., persistent on trunk and limbs. Timber brownish, fairly hard and rather free in the grain. Leaves 3–4 in. long, petioles ⅓–½ inch. Peduncles 3–5 lines. Flowers not seen. Fruits about 5 lines (1 cm.) long.

RANGE.

It is only known, at present, from the type locality in the Kimberleys, North West Australia, where it was collected by Mr. Fitzgerald, viz., summit of Bold Bluff, in sandy soil overlying quartzite.

(The closely allied *E. similis* is found in west Central Queensland. We want further collections between the localities recorded for the two species, not only that we may know more about them, but in order that this knowledge may enable us to say whether we are justified in keeping them apart, or whether they are forms of the same species.)

AFFINITY.

With ***E. similis*** Maiden.

The two species are so closely related that I regret that the material of *E. lirata* is so scanty that it is impossible to make a final pronouncement.

The colour and lustre (or absence of it) of the foliage of the two species resemble each other (as indeed does that of *E. eudesmioides*).

Mr. Fitzgerald says nothing of the yellowness of the bark of *E. lirata*, which is obvious in *E. similis*; one is an eastern and the other a western species, but these points must not be urged too strongly.

Of the material available to me of *E. lirata* (a few leaves, fruits, and seeds), together with Mr. Fitzgerald's description, I have spoken of the leaves, and my readers may also consult the figures. The fruits are different in the types, but those of *E. similis* (as shown in figure 4, Plate 184) approximate to the shape of those of *E. lirata* (figure 5*b*), although the former are larger. The fruits of *E. similis* would appear to be more numerous than those of *E. lirata*. Compare figures 3*e* and 5*b*, but, as regards the latter, the description says "3 to 5."

The seeds of *E. lirata* are wingless, like those of *E. similis*, but those of the former appear to be larger and rounder. At the same time I have not much of either before me.

DESCRIPTION.

CCXLVII. E. Baileyana F.v.M.

In *Fragm.* xi, 37 (1878).

FOLLOWING is a translation of the original :—

A tree, with angular branchlets, *leaves* scattered, papery, falcate-lanceolate, glaucous green, opaque, densely punctate, veins very fine, moderately spreading, peripheral vein rather distant from the margin, *umbels* axillary and lateral, solitary, 7–10 flowered, on a slightly compressed peduncle, *calyx* shortly pedicellate, the tube slightly longer than the semi-ovate or almost hemispherical, rather acute *operculum*, all the *stamens* fertile, anthers broadly cordate, *fruit* globose-urceolate, trilocular, margin of the orifice thin, valves deltoid, shortly exsert.

Moreton Bay, rare. Bailey.

Bark fibrous, persisting not only on the trunk but also on the branches, the inner bark tough and yellow. The timber, according to the discoverer, is yellowish. Leaves 3–5 inches long, ½–1 inch broad, the same colour on both sides, dull, thickly covered with slightly pellucid dots; veins inconspicuous, not closely pinnate. The flower-bearing peduncles about ½ inch long, the fruit-bearing ones double that length. Buds densely capitate, clavate-cylindrical; I have not seen fully developed flowers. Stamens inflexed before expansion. Fruit-bearing pedicels 2–4 lines long. Friut 5–7 lines long and broad, slightly wrinkled-striate, very obtuse at the base; the valves occasionally scarcely extending beyond the mouth of the calyx. Seeds not seen.

Mueller described the species in English in the "Eucalyptographia" with a figure, which, like the description, is erroneous in parts.

Mueller mixed up two trees under the one name. For example, in his "Eucalyptographia" figure, the lower part of the twig bearing the fruits is the true *E. Baileyana*. The rest of the figure, leaves, buds, and flowers, and of the details (again excluding the fruits and seeds) belong to a Stringybark nearest to *E. eugenioides* Sieb. The figure, therefore, is a composite one, the twig of *E. eugenioides* having been prolonged, and the fruits of *E. Baileyana* having been fitted on to it. In other words, no such plant exists as is figured.

I therefore re-described the species in the following words in my "Forest Flora of New South Wales," Part XXXV, p. 71 :—

Bark.—The bark is hard, thick, rather interlocked, and contains much kino. It is not a typical Stringybark—that is to say, its bark is not soft and fibrous.

Timber.—Of a light-grey colour when fresh, interlocked in grain, very tough, inferior in quality to that of the other Stringybarks (J. L. Boorman.)

Juvenile leaves.—Nearly ovate, not cordate at the base, tapering slightly at the apex to a blunt point or rounded. Common dimensions are 1½ inches broad and 3 inches long. The margin somewhat undulate, the intramarginal vein a considerable distance fom the edge. The under surface nearly white, densely besprinkled with stellate hairs, as also the rhachises. The upper surface bright green, in prominent contrast to the lower surface. This surface is very sparingly besprinkled with stellate hairs, or they may be entirely absent.

Mature leaves.—Lanceolate, symmetrical or falcate, gradually tapering to fine, though not rigid points. Five inches long, with a width in its broadest part of about ¾ of an inch, are common dimensions. The marginal vein close to the margin, or forming a thickening of the same; the lateral veins numerous and fine, parallel, and forming an angle of about 45 degrees with the midrib. Upper surface shiny, under surface paler and dull.

Flowers.—Umbels vary in number, but usually 5 to 7, the common flattened peduncle of about an inch; the flattened pedicels from ¼ to ½ an inch. Anthers small, versatile, with parallel cells and long narrow openings, with a relatively large gland at the back.

Buds.—Pear-shaped, the calyx irregularly toothed; the operculum nearly hemispherical, or with an umbo.

Fruits.—Rather large, globular-urn-shaped, 3-celled; margin of the orifice thinly compressed; valves deltoid, slightly exserted or hardly extending beyond the orifice; seeds without any appendage. (Mueller.) The largest fruits seen by me are about ⅝ of an inch wide, and the same deep.

RANGE.

The type comes from "Moreton Bay." More precisely, the locality from which the type was obtained is Eight Mile Plains, a few miles south of Brisbane.

It, however, is also found in northern New South Wales, and its known localities extend from 20 miles south of Grafton, New South Wales, in the south, to the Blackdown Tableland, about 100 miles west of Rockhampton, Queensland, in the north.

New South Wales.

Low, sandy country, about 20 miles south of Grafton. "Trees mostly hollow and ringy," showing that, as regards this particular locality, it is dying out.

"I do not remember having mentioned to you my meeting with the tree *E. Baileyana* (Bastard Ironbark) on the Clarence. I found it on some low, sandy country, about 20 miles south of Grafton. The trees I saw were from about 20 inches to 3 feet in diameter, and of medium height 25 to 40 feet to first branch. Bark dark, fibrous, and transversely interlocked, and very hard and tough. Trees mostly hollow or ringy." (Late Mr. Augustus Rudder.)

Copmanhurst, Clarence River (J. L. Boorman). "Fairly tall trees of 30-50 feet high, with girth measurements of 6–8 feet. The bole is free from branches up to 25–30 feet; is sound and heavy. The bark is thick-fibrous, but perhaps inferior for thatching purposes. The colour of the stem is a distinctive reddish colour, making it

prominent above all other trees in the district. The soil where it grows is of a sandy nature, ridgy, and of a poor quality. It is known locally as Stringybark. The timber is much esteemed locally."

Between Lawrence (Clarence River) and Casino (Richmond River). (W. Forsyth.)

QUEENSLAND.

Eight Mile Plains (F. M. Bailey and others). The type.

Between Sunnybank and Mt. Gravatt. (C. T. White.)

The next locality of which I have a record is approximately 500 miles to the north-west.

"Good development, distribution scattered. Elevation about 2,400 feet. Blackdown Tableland near Dingo, 100 miles west of Rockhampton." (P. MacMahon, N. W. Jolly.)

It is quite evident that we have much to learn in regard to the range of this species, particularly in Queensland, and it is very probable that a careful investigation of the trees of the Blackdown Tableland would yield interesting and perhaps unexpected results.

AFFINITIES.

1. With ***E. dichromophloia*** F.v.M.

The species in the fruit somewhat resembles *E. dichromophloia*, otherwise it is very different. The true affinity of this species will be better shown when expanded flowers are available. (Original description.)

2. With ***E. Bowmani*** F.v.M.

Mueller, "Eucalyptographia," goes into the supposed differences of these two species at some length, but as (see the present work, Part X, p. 344) we do not know what *E. Bowmani* is, we may defer consideration of the comparisons until we do.

3. With ***E. trachyphloia*** F.v.M.

". . . its leaves are paler beneath, and their veins very divergent and copious; the stalklets are thin; the lid is much smaller, and exceeded in width and still more so in length by the tube of the calyx, separating moreover by an irregular rupture and not a clearly defined circumcision: the anthers are ovate, whereas the fruit is much smaller, nearly twice as long as broad, with deeply enclosed valves." ("Eucalyptographia," under *E. Baileyana*.)

4. With *E. eugenioides* Sieb.

"Finally it may be observed that *E. Baileyana* exhibits great resemblance to *E. eugenioides* both in leaves and flowers, although the fruits are so very decidedly different. . . ." ("Eucalyptographia," under *E. Baileyana.*) The comparison with *E. eugenioides* more particularly arose through the confusion between the two species, as already detailed.

The comparisons with *E. Baileyana* already referred to for the most part fall to the ground because, in his original description, Mueller described portions of two species, as already explained.

E. Baileyana is a true member of the Eudesmieæ, and it is with species of that series that it can be most suitably compared. Its closest affinity appears to be with *E. tetradonta.* The matter will be further dealt with when the whole of the Eudesmieæ are passed under review. See Part XLV.

DESCRIPTION.

CCXLVIII. E. Lane-Poolei Maiden.

In *Journ. Roy. Soc. N.S.W.*, liii, 107 (1919).

FOLLOWING is the original description :—

Arbor mediocris, White Gum vocata; cortice crassa, pulvere alba tecta; ligno hepatico; foliis primariis lanceolatis vel lato-lanceolatis, ca 6 cm. longis 3 cm. latis, venis secondariis fere parallellis; foliis maturis breve petioliatis, lanceolatis, acuminatis subfalcatis, ca 10 vel 11 cm. longis, 2 cm. latis, venis inconspicuis; pedunculis teretibus, ca 1·5 cm. longis, plerumque 4–6 floris, pedicellis, teretibus 1 cm. longis; calycis tubo ca. 1 cm. diametro, fere hemispherico; operculo crassissimo, hemispherico; antheris grandis fissuris parallelis late dehiscentibus; fructibus hemisphericis, ca. 1 cm. diametro, margine lato, leniter convexo, valvis distincte exsertis.

A medium-sized tree, known as "White Gum," and carrying a thick bark covered with a white powder. Sapwood pale-coloured and thick, the timber interlocked, and rich reddish-brown in colour, drying, in the course of years, to a deep purplish-brown.

Juvenile leaves shortly petiolate, lanceolate to broadly-lanceolate, about 6 cm. long by 3 cm. broad, of the same colour on both sides, the secondary veins moderately spreading, and tending to be parallel to each other. A vein more prominent than the other secondary veins, roughly following the outline of the leaf, but at a considerable distance from the margin, and giving the leaf a triplinerved appearance.

Mature leaves shortly petiolate, lanceolate, acuminate, slightly falcate, not large, usually about 10 or 11 cm. long, and up to 2 cm. broad, venation inconspicuous, the fine veins roughly parallel and making an angle of about 45 degrees with the midrib, intramarginal vein hardly removed from the edge.

Peduncles axillary or lateral, terete, about 1·5 cm. long, bearing usually 4 to 6 moderately large flowers on terete pedicels up to 1 cm. long. Buds shiny.

Calyx-tube nearly hemispherical, about 1 cm. in diameter, with two slightly raised ridges separated by 180 degrees; tapering rather abruptly into the pedicel.

Operculum very thick, hemispherical or terminating in a slight but sharp point when nearly ripe. When less ripe, slightly broader than the calyx-tube, and without a point.

Stamens about 9 mm. long, inflected in the bud, anthers large, opening widely in parallel slits. Gland long, faintly visible at the back. Filament at the base. The anthers belong to the Platyantheræ group.

Disc broadish, oblique, forming a prominent ring round the ovary, of which the obtusely conical centre protrudes slightly above the disc at the time of flowering.

Fruit hemispherical, about 1 cm. in diameter, the rim broad, slightly convex, the capsule not sunk, the valves conspicuously exsert.

Type from Beenup, W.A. (C. E. Lane-Poole, No. 465).

Named in honour of Charles E. Lane-Poole, Conservator of Forests of Western Australia, who collected this species, and who has done much to promote the study of this genus in his State.

RANGE.

It is confined to Western Australia, and, so far as is known at present, to a strip of coast-land, more or less ascending the Darling Range, in the south-western portion of the State, on the Perth-Bunbury Railway Line, between Kelmscott 16, and Waroona, 70 miles south of Perth.

"Very clean White Gum, Kelmscott, foot of Darling Range, 16 miles south of Perth." (Dr. J. B. Cleland, No. 4.) Figured at fig. 4*a* and 4*b*, Plate 74, of the present work.

"White Gum," 40 feet high, 12 inches in diameter, near Beenup, S.W. Railway, on the Perth to Bunbury road, 24 miles south of Perth (C. E. Lane-Poole, No. 8, November, 1918, fruits only; No. 465, July, 1919, complete material).

"A White Gum, sandy scrub land, Serpentine River, W.A." In Herb. Melb., and variously attributed by Mueller (on the label) to *E. uncinata* and to *E. micranthera*.* It is a very old specimen, and is figured at fig. 8*a*, 8*b*, 8*c* of Plate 74 of the present work. This and the following three localities are practically identical.

"Salmon-white Gum or Powder Bark Wandoo. Height to about 40 feet, to 3 feet in diameter." Near Keysbrook (39 miles south of Perth), near the Belgobin School, on the Perth-Bunbury road. (Mr. Schock, through C. E. Lane-Poole, under the same number, 8, as given to some Beenup specimens.)

Tree of 40 feet, 3 feet in diameter. Keysbrook, Perth-Bunbury road (Mr. Schock, per Dr. F. W. Stoward, No. 1).

"Salmon Gum or Powder-bark Wandoo," half a mile south of Serpentine River on Perth-Bunbury road. (Mr. Schock, per Dr. F. W. Stoward, No. 90.)

Sent as "Wandoo," Waroona, January, 1903 (Forester J. J. Fitzgerald). Waroona is 70 miles south of Perth, and I could only obtain buds. Referred to at p. 224, Part XVII of the present work.

AFFINITIES.

1. With *E. redunca* Schauer.

That officers of the Forest Department of Western Australia should, quite independently, in 1903 and 1918, speak of this as a Wandoo, shows that the general appearance of the tree, its bark and timber, must bear more than a superficial resemblance to the true Wandoo (*E. redunca*). But comparison of the figures 4 and 8, Plate 74 of this work, which partly depict *E. Lane-Poolei*, and Plate 140, which shows *E. redunca*, shows that the two species are botanically very dissimilar.

* This is the specimen referred to at Part XX of the present work, bottom of page 308, under *E. micranthera*. There is, however, very little affinity between the two species.

2. With *E. accedens* W. V. Fitzgerald.

Mr. Schock, the Collector of the Forest Department of Western Australia, calls *E. Lane-Poolei* "Powder-bark Wandoo." Both species are White Gums, with white, powdery barks, and the timbers have some external resemblance. The sylvicultural conditions of the two trees require to be worked out. As to the use of the term "Powder-bark," Part XXXIV, p. 101, of this work may be referred to. If we turn to Plate 142 of the same Part, and compare it with figures 4 and 8 of Plate 74, which in part depict *E. Lane-Poolei*, it will be seen that the two species have no close botanical affinity.

3. With *E. Oldfieldii* F.v.M.

The affinity of this species is with *E. Oldfieldii*, which included *E. Drummondii* Benth., a species which in Part XVII of this work I erroneously followed Mueller in suppressing. I have shown, in Part XLI, how these two species differ. The affinity of *E. Lane-Poolei* is with *E. Drummondii* rather than with *E. Oldfieldii sensu strictu*. *E. Oldfieldii* is a Mallee with fruits in threes, while *E. Lane-Poolei* is a tree of considerable size, with fruits up to six in the head. The buds and leaves, both juvenile and mature, are very different.

4. With *E. Drummondii* Benth.

This species, of which but little is known in the field, is described from the York district as "a small tree of about 20 feet, with trunk and branches smooth, whitish-buff, with a few brown semi-detached scales of dead bark." Additional field-notes are very desirable, but it would appear that *E. Lane-Poolei* is a different tree, and a Powder-bark.

Comparison, however, with figures 3, 5, 6, 7, 9, 10 of Plate 74 (*E. Drummondii*), together with a good specimen of the type of this species, is sufficient to show that it and *E. Lane-Poolei* (figures 4 and 8 of Plate 74) are sufficiently different. The leaves of *E. Drummondii* are commonly, perhaps preponderatingly, ovate-lanceolate, the buds more ovoid, with the opercula longer than the calyx-tube; the fruits are smaller, and very different.

5. With *E. Campaspe* S. le M. Moore.

It is interesting to note a resemblance in the very thick, hemispherical operculum of *E. Campaspe*, but the anthers are different, and so are the fruits and other characters. But one so frequently receives, particularly from distant places, botanical specimens which are quite fragmentary, and a hint which may put one on one's guard may be useful.

6. With *E. oleosa* F.v.M.

In its anthers it belongs to the Platyantheræ, which includes *E. oleosa* and its allies. The species are, however, very different in many other respects, but endeavour will be made to discuss these relationships when the seedlings of all the species are brought into comparison.

DESCRIPTION.

CCXLIX. E. Ewartiana Maiden.

In *Journ. Roy. Soc. N.S.W.*, liii, 111 (1919).

FOLLOWING is the original description :—

Frutex Mallee similis, 20′ altus, multis caulibus 3″ diametro; cortice decidua peculiariter striatis; foliis primariis crassiusculis, late ovato-lanceolatis vel fere orbicularibus, 7 cm. latis, 10 cm. longis; foliis maturis petiolatis, lanceolatis, 5–7·5 cm. longis, 1·5–2·25 cm. latis, petiolo 1–1·5 cm. longo, crassis, venis patentibus; pedunculis teretibus 2 cm. longis, 2–7 flores breve pedicellatos umbella gerentibus; alabastris clavatis, operculo hemispherico, ca. 8 mm. diametro, calycis tubo angustioribus; antheris, forma irregulare paralleliter aperientibus, filamentis brevibus; fructibus conoideo-globosis, ca. 12 mm. diametro, margine latissimo, truncato, conoideo; capsula non depressa, valvis leniter exsertis.

Many-stemmed, 10–15 or 20 feet high. Somewhat Mallee-like in habit. The stems 3 inches in diameter, and the timber tough and pale. The bark is peculiar, falling off in narrow, longitudinal pieces, giving it a striped appearance, which, if not unique, is certainly rare in Eucalyptus. Wood hard, the centre deep reddish-brown.

Juvenile leaves (described from Kunnunoppin, No. 146) with petiole of 1 cm., broadly ovate-lanceolate to nearly orbicular, 7 cm. broad by 10 cm. long, very thick, venation spreading.

Mature leaves lanceolate, 5–7·5 cm., say, 2 to 3 inches long, and 1·5–2·25 cm., say three-quarters to 1 inch broad, with a petiole of half to three-quarters of an inch (say, 1–1·5 cm.) long. Dull yellowish-green on both sides, thick, venation spreading, the secondary veins not very prominent and meeting the midrib at about an angle of 45 degrees; the intramarginal vein distinctly removed from the edge.

Peduncles terete, long (say, 2 cm.), each supporting an umbel of 2–7 flowers on short but distinct terete pedicels.

Buds clavate, very yellow, with hemispherical operculum, about 8 mm. in diameter, and no mucro. The operculum less in diameter than the calyx-tube, and affording an excellent example of "egg-in-egg-cup," *i.e.*, showing the place at the commissural rim of a deciduous additional operculum.

Anthers most irregular in shape and opening in parallel slits. The gland sometimes seen on the top and sometimes at the base. The filament attached nearly half-way up at the back of the anther. It is included in the Macrantheræ. Filaments very short, the stigmas not dilated.

Disc forming a broad, conical, truncate band around the ovary, which becomes less truncate as the fruit develops. In its early stages it resembles a hat with a depressed crown.

Fruits conoid-globose, about 12 mm. in diameter, the rim very broad, truncate-conoid, at length almost conical, the capsule not depressed, the valves slightly exsert.

Named in honour of Alfred J. Ewart, D.Sc., Professor of Botany and Vegetable Physiology in the University of Melbourne, well known for his researches on the Australian flora.

Type, Pindar, W.A. (J.H.M., October, 1909).

RANGE.

This is a species of dry country, mainly recorded, so far, from Western Australia, but, by the Elder Expedition, found first in South Australia and subsequently in the western State.

Western Australia.

"Many-stemmed, 10–15 or 20 feet. Tough wood. Peculiar bark, falling off in narrow, longitudinal pieces, giving a striped appearance. The indurated stems are 3 inches in diameter. Several clumps seen. Very yellow buds, with hemispherical operculum, and absolutely no mucro. Operculum, which is distinctly smaller than the calyx, affording one of the best examples I remember of the "egg-in-egg-cup" bud. Leaves greenish-yellow, dull coloured. The material I have is figured at 11, Plate 74." The above statement will be found at p. 225, Part XVII of the present work. (66¼ mile post, Pindar, Murchison Line, J.H.M., October, 1909.)

"Bark decorticating from 1 foot from the ground. Mallee, branching from the ground to a height of 15 feet and up to 6 inches in diameter. The bark at base grey, rough, decorticating in rolled up grey strips leaving the stem, which is red in colour, with a peculiar streaked appearance. On rubbing, the loose pieces of bark come off easily, leaving the stem more or less smooth." Near Government Tank, Westonia. This is 6 miles north of Carrabin, a railway station 195 miles east of Perth. (C. E. Lane-Poole, Nos. 220, 463.)

Shrub 5–8 feet, several stems springing from base, 2–3 inches diameter, bark smooth above, inclined to be rough at base. Open flowers and young fruits. On iron stone gravel on high land. Best specimens always near the summit, Kunnunoppin district. (Dr. F. Stoward, No. 144.)

"Shrubby Mallee, 8–10 feet. Sucker leaves, flowers, mature fruits, and bark. Found on ironstone ridge, Kunnunoppin district." (Dr. F. Stoward, No. 146). The bark precisely similar to that of the Pindar specimens, but the leaves of this specimen are broader than those of the type.

"*Eucalyptus Oldfieldii*, mountain form." Mount Cooper, Cavenagh Range, R. Helms, 31st July, 1891. "A dwarf state at 2,500 feet elevation." This locality is in Western Australia, and the Camp No. 31, long. 128 degrees.

South Australia.

"*Eucalyptus Oldfieldii*," Elder Expl. Exped., R. Helms, 15 feet high, 12th June, 1891. The Expedition was then in the vicinity of Yeelunginna Hill in South Australia, say, in lat. 27° 20″ S., long. 131° 70″ E.

AFFINITIES.

1. With *E. Oldfieldii* F.v.M.

There has been great confusion between *E. Oldfieldii* and *E. Drummondii*, and the present species, like *E. Lane-Poolei*, has been carved out of the aggregate. The affinity of *E. Lane-Poolei* inclines to *E. Drummondii*, and so does the present species in general characters, but both *E. Ewartiana* and *E. Oldfieldii* are dry-country Mallees. Mueller and Tate looked upon the Elder Expedition specimens as a mountain form of *E. Oldfieldii*. Both species have fruits with broad rims, though the sculpture is not the same in both. The fruits of *E. Ewartiana* are smaller, more numerous, have long peduncles, and are distinctly pedicellate. The operculum is very different to that of *E. Oldfieldii*; it is hemispherical, and shows a contraction with the calyx-tube which is not observable in *E. Oldfieldii*. The two species also differ in other characters.

2. With *E. Drummondii* Benth.

Compare fig. 11, Plate 74 (*E. Ewartiana*), with figs. 3, 5, 6, 7, 9, 10 of the same Plate (*E. Drummondii*). The buds of *E. Drummondii* are more ovoid than those of *E. Ewartiana*; the former have much longer and slenderer pedicels. The shape of the fruit is different in the two species, that of *E. Drummondii* having a more convex rim, with the tips of the valves more exsert. The mature leaves of *E. Drummondii* are usually more or less ovate-lanceolate, a character not observed in those of *E. Ewartiana*. The juvenile leaves of *E. Ewartiana* are remarkably coriaceous, and so broadly lanceolate as to be almost orbicular.

3. With *E. Lane-Poolei* Maiden.

E. Lane-Poolei is a moderately large White Gum, found in coastal situations; *E. Ewartiana* is a Mallee frequenting regions of low rainfall. The foliage of the former is thin, lanceolate to narrow lanceolate; that of the latter much broader and thicker, with the juvenile foliage remarkably coriaceous and so broad as to be almost orbicular, and considerably larger than that of *E. Lane-Poolei*. While the texture of the operculum of *E. Ewartiana* is thinnish, that of *E. Lane-Poolei* is remarkably thick, while comparison of the figures on Plate 74, viz., 4 (*E. Lane-Poolei*) and 11 (*E. Ewartiana*) shows that they are widely different.

4. With *E. accedens* W. V. Fitzgerald.

In the size, paleness and extreme coriaceousness, I know only one species whose juvenile leaves resemble those of *E. Ewartiana*, and that is *E. accedens*. See fig. 8, Plate 141, of the present work. But in almost every other character the two species diverge.

DESCRIPTION.

CCL. E. Bakeri Maiden.

In *Journ. Roy. Soc. N.S.W.*, xlvii, 87 (1913).

FOLLOWING is the original description :—

Frutex altus similis Mallee, vel arbor parva 30–50′ alta. Trunci cortex dura et squamosa. Ramuli laeves. Lignum durum, grave, rubrum. Folia juvena obscuro-virentia, concoloria, linearo-lanceolata, vix acuminata, 9 cm. longa, 1 cm. lata, oleosa, indistincte venosa, penniveniis, vena peripherica a margine remota. Umbellæ plerumque axillares, multifloræ, saepe 10–13 floræ. Operculum elongatum calycis tubo multo longiore, cujus diameter leniter latior est. Fructus diametro circiter 5 mm., truncato-spheroidei. Valvarum apices subulati, 2 mm. exserti.

A large shrub or small, pendulous, Willow-like tree, attaining a height of 30–50 feet, forming a single stem or stooling from the ground.

Bark dark, box-like, or hard and scaly up to its branches, falling away in long flakes, rough at the butt, branches clean, bluish-green or pale-yellow to white right up to the tips.

Wood hard and heavy, of a deep red when freshly cut, becoming browner with age, the grain of the timber fibrous, very tough, reputed to be an excellent timber for wheelwrights' work.

Juvenile leaves dull green on both sides, linear-lanceolate, hardly acuminate, about 6 or 7 cm. long, the venation not distinct, the intramarginal vein close to the edge, the lateral veins penniveined, plentifully besprinkled with oil-dots and the branchlets angular and glandular.

Mature leaves linear-lanceolate, petiolate, acuminate or with a hooked tip, bright-green, dull-shiny, richly covered with oil-dots, venation indistinct, the intramarginal vein distinct from the edge, the lateral veins penniveined. Average dimensions 9 by 1 cm.

(If the species were gregarious, it would probably be found to be a valuable oil-yielding species.)

Flowers.—Umbels mostly axillary and flowers numerous, often 10–13 in an umbel, which sometimes takes on a stellulate appearance. Operculum elongated, very much longer than the calyx-tube, which is of slightly increased diameter, and which tapers, somewhat abruptly, into the short pedicel. The common peduncle about 1 cm.

Anthers small, renantheroid, but the two cells more united than in the Renantheræ; spherical gland at top and back.

Fruits.—Small, about 5 mm. in diameter, truncate-spheroid, the tips of the valves awl-shaped, and protruding 2 mm. from the orifice.

Enclosing the valves, and torn by the tips of them as the fruit ripens is a thin, white membrane, which gives the rim and orifice a whitish appearance, and which, if present in all, is only obvious in a few species of this genus.

This is a specially interesting species, rich in oil, which I name in honour of Mr. Richard Thomas Baker, who has done very valuable work in connection with this genus.

RANGE.

It extends from northern New South Wales to Central Queensland, so far as we know at present.

Following are specimens in the National Herbarium, Sydney. I am satisfied that careful research will bring many new localities to light.

NEW SOUTH WALES.

1. "Willowy Eucalypt," Warialda, N.S.W. (W. A. W. de Beuzeville, No. 3).

2. Ticketty Well, Wallangra (E. H. F. Swain, July, 1911. The type. J. L. Boorman, December, 1912). "Tree-like Mallee," 28 feet high and 5 inches in diameter, wood brown, bark grey up to 6 feet, then yellowish. Ticketty Well, locality of type. (Forest Guard A. Julius, Nos. 17 and 19). The leaves of these specimens are broader than those of the type (*Journ. Roy. Soc. N.S.W.*, liii, 68, 1919).

QUEENSLAND.

3. "Small bush, grows up to 10 feet high, grows very thickly on the poorest soil, where there is no Ironbark cover." Warwick (Forester W. E. Moore, through C. T. White).

4. Near Jericho (J. L. Boorman). It is a Mallee, and it would appear that Mallee is rare in the northern State. It grows in masses on red, stony ridges around the black soil of the flats, up to 10 feet high as seen. Gidgee (*Acacia Cambagei* R. T. Baker) and *Gastrolobium grandiflorum* F.v.M. grow in the immediate neighbourhood. (*Proc. Roy. Soc. N.S.W.* xlvii, 235, 1913, as *E. oleosa.*)

AFFINITIES.

It is a remarkable, narrow-leaved species, with narrow juvenile foliage, buds with long opercula of less diameter than the calyx-tube, and small fruits with well exserted awl-like tips to the capsules. It is not easy to indicate its closest affinity, showing that it is a strong species.

1. With *E. uncinata* Turcz.

It would appear to have affinity to *E. uncinata* Turcz., but Mr. Boorman, an experienced collector, is emphatic that the two species are very different in habit. *E. Bakeri* is a tree of 50 feet and even more, reminding one of a Willow; indeed, it was first sent in as "Willowy Eucalypt." The foliage is narrow, and somewhat dull in appearance; the anthers are very similar, but not identical, while there is no kink in the filament in the stamens of *E. Bakeri.* (Original description.)

For *E. uncinata* turn to Plate 62, Part XIV. *E. Bakeri* has narrower leaves (as a very general rule), and narrower juvenile leaves; the anthers are different, though not widely so. The buds of the two species sufficiently resemble each other to necessitate caution, but the fruits are different.

2. With *E. viridis* R. T. Baker.

Drawings of *E. viridis* (under *E. acacioides* A. Cunn.) may be seen at figs. 9–12, Plate 52, Part XI of this work, and a larger drawing at Plate 180 Part XLVIII of my "Forest Flora of New South Wales." The latter has fruits with thin rims and non-exsert valves.

3. With *E. salmonophloia* F.v.M.

Its fruits remind one of those of the Western Australian *E. salmonophloia* F.v.M., but those of the latter species are smaller, more shiny, have thinner and more marked pedicels. (Original description.)

For *E. salmonophloia* see Part XVII, Plate 73. It may be added that the latter is a large timber tree, with smooth bark, and different anthers.

4. With *E. Seeana* Maiden.

E. Seeana Maiden is another species with small fruits (which are, however, domed), and a long operculum (more tapering into the calyx-tube in *E. Seeana*), leaves different, and the bark of *E. Seeana* is smooth. (Original description.) For *E. Seeana* see Part XXXII, Plate 132.

5. With *E. redunca* Schauer.

E. redunca Schauer var. *angustifolia* Benth., is another narrow-leaved, long operculumed form. It is from south-western Australia, and has no close affinity to the present species.

Other narrow-leaved species are *E. angustissima* F.v.M. and *E. apiculata* Baker and Smith, but they have no special affinity to this species. (Original description.) For *E. redunca* var. *angustifolia* see Part XXXIV, Plate 140.

6. With *E. oleosa* F.v.M.

E. oleosa F.v.M. bears an obvious resemblance as far as the fruits are concerned, but those of the new species are smaller, and in leaves and in most other respects the affinities are not obvious. (Original description.) It is amusing that, nevertheless, I should have first recorded the Jericho specimen as *E. oleosa*. For *E. oleosa* see Part XV, Plate 65. The latter species has, however, broad juvenile foliage.

DESCRIPTION.

CCLI. E. Jacksoni Maiden.

In *Journ. Roy. Soc. N.S.W.*, xlvii, 219 (1913).

FOLLOWING is the original description :—

Arbor magnifica sylvæ, altitudinem 200′ attinens, et 15′ diametro. " Red Tingle Tingle " vocata. Cortex " Stringybark " similis sed fragiliuscula. Lignum rubrum, durum. Folia juvenilia fere orbicularia vel lato-lanceolata. Folia matura petiolata, lato-lanceolata, acuminata, pleraque 9 cm. longa, 3–4 cm. lata. Venæ visibiles, non conspicuæ. Alabastros floresque non vidi. Fructus fere sphærici, plerique 8 mm. ad 1 cm. diametro. Orificium parvum, 3 mm. diametro. Valvarum apices sub orificio valde depressi.

A noble forest tree up to 200 feet high, erect in habit, with a long trunk, which attains a diameter of 15 feet (measured at 4 feet from the ground). Another measured tree was 7 feet 6 inches in diameter and 80 feet high (Mr. Saw). It reached a height of quite 200 feet; one tree measured was 45 feet round the base, 38 feet round 6 feet from the ground, and about 50 feet to the first branch (Mr. Brockman). Known locally as " Red Tingle Tingle."

Bark fibrous, reddish, thick, of a stringybark character, but somewhat brittle, covering the trunk and branches.

Timber bright red, reminding one, in that respect, of the Forest Mahogany of New South Wales (*E. resinifera* Sm.). It is fissile and tough, and I believe it to be a most valuable timber for economic purposes.

Juvenile leaves.—Nearly orbicular to broadly lanceolate, somewhat oblique, paler on the under side, not specially thin, venation distinct but fine, lateral veins nearly parallel, intramarginal vein well removed from the edge. Oil-dots abundant. Average dimensions about 1 dm. long by 6 to 8 cm. wide.

Mature leaves.—Equally green on both sides, petiolate, broadly lanceolate, acuminate, slightly curved, slightly inequilateral, veins obvious, but not very conspicuous, lateral veins parallel, intramarginal vein well removed from the edge, well besprinkled with fine oil-dots, and apparently moderately rich in oil. Average size of leaves 9 by 3 to 4 cm.

Buds and flowers not seen.

Fruits.—Almost spherical, with an average diameter of 8 mm. to 1 cm., with a small orifice, of say, 3 mm. in diameter. Tips of valves well sunk below the orifice.

[Since the above was written I have received half-grown buds, as figured, fig. 7, Plate 183. They may be described as clavate, four or five in the head (as seen in very few specimens) with rather long peduncles and with distinct pedicels, tapering gradually into the calyx-tube. Operculum hemi-ellipsoid, about half the length of the calyx-tube.]

RANGE.

So far as we know, this species is confined to South-western Australia.

Deep River, Nornalup Inlet, Bow River, Irwin's Inlet, South-west Australia. (The type collected by Sidney Wm. Jackson.) Found also on the hills along the Frankland River, where it predominates and extends about 10 miles up. (Inspecting Ranger H. S. Brockman, to the Inspector-General of Forests, W.A.)

As opportunities occur, no doubt the range of this species, and also the Yellow Tingle Tingle (*E. Guilfoylei*) will be carefully defined, as they yield valuable timbers.

AFFINITIES.

1. With *E. Guilfoylei* Maiden.

Although there are precedents, I hesitate to describe a species in absence of inflorescence, and without this, the description must be incomplete. But I have no doubt as to the validity of the species. It is closely allied to the Yellow Tingle Tingle (*E. Guilfoylei* Maiden, *Journ W.A. Nat. Hist. Soc.*, iii, 180; see also Part XX of the present work), the wood of which is pale, of a yellow colour and heavy, that of the present species being red, and lighter in weight.

The Red Tingle Tingle is a much larger and thicker tree than the Yellow Tingle Tingle, the latter having been observed only up to 5 feet in diameter.

As regards the adult leaves, those of *E. Guilfoylei* are always symmetrical, or nearly so; those of *E. Jacksoni* are more or less oblique, shorter, and broader.

The oil-dots in *E. Guilfoylei* are a greater distance apart than in the case of the new species, over the leaves of which they are evenly and abundantly diffused, while the secondary veins are further apart and ramify more in the case of the leaves of *E. Guilfoylei*. (Original description.)

2. With *E. patens* Benth.

Mr. H. S. Brockman says that "in general appearance the trees resemble very much the Blackbutt" (*E. patens*). Reference may be made to the original description of *E. Guilfoylei*, where there are some comparative references to *E. patens*.

DESCRIPTION.

CCLII. E. eremophila Maiden.

In *Journ. Roy. Soc. N.S.W.*, liv. 71 (1920).

FOLLOWING is the original description :—

Frutex vel arbor mediocris, cortice læve, squamosa, ramulis glaucescentibus; foliis junioribus angusto-lanceolatis vel lanceolatis; foliis maturis lineari-lanceolatis ad lanceolatis, coriaceis, nitentibus venis secondariis tenuibus sed remotiusculis, non pennivenis, pedunculis elongatis, applanatis, pedicellis fere teretibus ca. 5 mm. longis, calycis tubo oblongo vel cylindroideo, turbinato, ca. 5 mm. longo; operculo cornuto calycis tubo ca. quinquies æquilongo, diametro distincte minore; filamentis antherisque cornutis similibus; fructibus cylindroideis vel sphæricis, calycis tubo crasso, capsulæ apice applanato fere margini aequante, fructu truncato.

A shrub or medium-sized tree, with smooth, scaly bark. Branchlets glaucescent.

Juvenile leaves (suckers) not available, in the earliest stage, but probably narrow. Those of the seedlings are narrow-lanceolate to lanceolate.

Mature leaves linear-lanceolate to lanceolate, coriaceous, shiny, not glaucescent, the secondary veins fine but rather distant, and, at all events in the intermediate stage, spreading and roughly parallel, not feather-veined.

Peduncles elongate, flattened; pedicels nearly terete, distinct, about 5 mm. long.

Calyx-tube oblong or cylindroid turbinate, about 5 mm. long.

Operculum sometimes coloured (reddish), straight or horn-shaped, up to 5 times as long as the calyx-tube, and much less in diameter. Filaments yellowish, sometimes crimson, angular, glandular, and with anthers as in the Cornutæ.

Fruits cylindroid to spherical; top of the capsule nearly flush with the rim, giving the fruit, when not fully ripe, a characteristically truncate, flattish appearance. When the fruit is ripe its mouth becomes rounded and somewhat contracted.

SYNONYM.

E. occidentalis Endlicher, var. *eremophila* Diels, in *Engler's Jahrb.*, xxxv, 442, 1905. See also Part XXXVI, p. 147, of the present work. Figured at Plate 149, figures 7–11.

The relations of *E. occidentalis* Endl. var. *grandiflora* Maiden (Part XXXVI, p. 149, and figures 1 and 2, Plate 150) to *E. eremophila* remain a matter for further consideration.

RANGE.

It is confined to Western Australia, so far as we know at present, but it is quite possible that it may occur in western South Australia.

This is a dry country form, and its range may be stated as bounded by Watheroo, on the Midland Railway, to 140 miles east of Kalgoorlie, and north of Esperance and back again to the vicinity of the Great Southern Railway. It probably has a very extensive range in country of low rainfall.

"Shrub 4 metres high, flowers yellow, calyptra (opercula) reddish." Near Coolgardie (Dr. L. Diels, No. 5,237). Coolgardie, or rather, Boorabbin (E. Pritzel, No. 917). I have also received it from Coolgardie (L. C. Webster).

The type comes from Coolgardie. Other localities are quoted, *op. cit.* p. 148.

AFFINITIES.

It is a member of the Cornutæ.

1. With *E. occidentalis* Endl.

It is sharply separated from this species in its narrow juvenile foliage, that of *E. occidentalis* being broad. Those of the former are shiny, with more numerous oil-dots. Buds usually longer, hence with longer filaments; staminal disc broader. The fruit of *E. occidentalis* is campanulate, while that of *E. eremophila* is cylindroid or inclining to hemispherical.

2. With *E. platypus* Hook.

Here I invite attention to the similarities and dissimilarities I have brought forward at pages 151 and 152 of Part XXXVI of the present work.

Explanation of Plates (180–183).

PLATE 180.

E. perfoliata R. Br.

1*a*. Pair of young connate leaves; 1*b*, fruit with a very short stalk. Roe's River, York Sound, North-west Australia. (Allan Cunningham, No. 238, September, 1820.)

2*a*. Portion of leaf, not in the perfoliate state; 2*b*, flowers; 2*c*, anthers. "North-west Coast, Australia" (Surgeon Bynoe). (Nos. 1 and 2 were drawn by Miss M. Smith, of Kew, from original specimens in the Kew Herbarium).

3*a*. Pair of leaves, still in the "juvenile" stage, and yet the plant is bearing flower-buds; 3*b*, sessile fruit. Lennard River, Kimberleys (W. V. Fitzgerald, No. 333.)

4. Fruit, more urceolate than the type. King's Sound, North-west Australia (W. W. Froggatt, 1886).

5. Buds. Mt. Anderson and Grant Range, Kimberleys. (W. V. Fitzgerald, August, 1906). The fruits of this specimen are similar to 3*b*, but with rather smaller orifice.

PLATE 181.

E. ptychocarpa F.v.M.

(See also Plate 182.)

1a. Juvenile leaf (as young as I have seen); 1*b*, fruit, the ribs not winged and the fruit more globular than in the type. In swamps, Northern Territory, north of 15° (W. S. Campbell).

2*a*, Intermediate leaf; 2*b*, bud, with ribs; 2*c*, buds and flowers, the ribs almost winged; 2*d*, front and back views of anthers. Eight Mile Spring on to Tamburini, Northern Territory (G. F. Hill, No. 809).

3. Fruit; Bathurst Island, Northern Territory (G. F. Hill, No. 469).

PLATE 182.

E. ptychocarpa F.v.M. (See also Plate 181.)

1. Buds and flower, with long peduncle, long pedicels, and long filaments. Pine Creek, Northern Territory (C. E. F. Allen, No. 116.)

2*a*. Mature leaf; 2*b*, bud; 2*c*, fruits. Woollybutt Creek, near Phillips Range, North West Australia (W. V. Fitzgerald, No. 950.)

E. similis Maiden.

3*a*. Juvenile leaf; 3*b*, mature leaf; 3*c*, buds; 3*d*, front and back view of anthers; 3*e*, fruits. Desert country, west of Emerald, Queensland (G. H. Carr). The type.

4. Fruits. Alice, 328 miles west of Rockhampton, Queensland (W. Pagan, through C. T. White).

E. lirata (W. V. Fitzgerald) Maiden.

5*a*. Mature leaf; 5*b*, fruits. Summit of Bold Bluff, Kimberleys, North West Australia. (W. V. Fitzgerald, No. 843). The type.

E. Baileyana (Maiden) F.v.M.

(See my "Forest Flora of New South Wales," Part XXXV, p. 71, Plate 132, where it will be seen that I have amended Mueller's original description and figure of the species.)

6*a*. Two juvenile leaves, bearing stellate hairs; 6*b*, mature leaf; 6*c*, buds; 6*d*, front and back views of anther; 6*e*, calyx-tube; 6*f*, fruits. Eight Mile Plains, Brisbane, Queensland (A. Williams). The locality is that of the type, and the drawings are taken from the "Forest Flora" plate already quoted.

PLATE 183.

E. Lane-Poolei Maiden.

1*a*. Mature leaf; 1*b*, buds; 1*c*, front and back view of anther. Beenup, Perth to Bunbury Railway Line (C. E. Lane-Poole). The type.

(This species was formerly figured as *E. Oldfieldii* F.v.M. in figures 4 and 8, Plate 74, Part XVII of the present work.)

E. Ewartiana Maiden.

2. Fruits (larger than the type), Camp 4, vicinity of Yeelunginna Hill, say, in lat 27, 20 S., long. 131, 70 E., South Australia. Elder Exploring Expedition (recorded by Mueller and Tate as *E. Oldfieldii*). (R. Helms, 12th June, 1891.)

3*a*. Juvenile leaf; 3*b*, anther, three views. Pindar, W.A. (J.H.M.).

(This species was formerly figured as *E. Oldfieldii* var. *Drummondii* in figure 11, Plate 74, Part XVII of the present work.)

E. Bakeri Maiden.

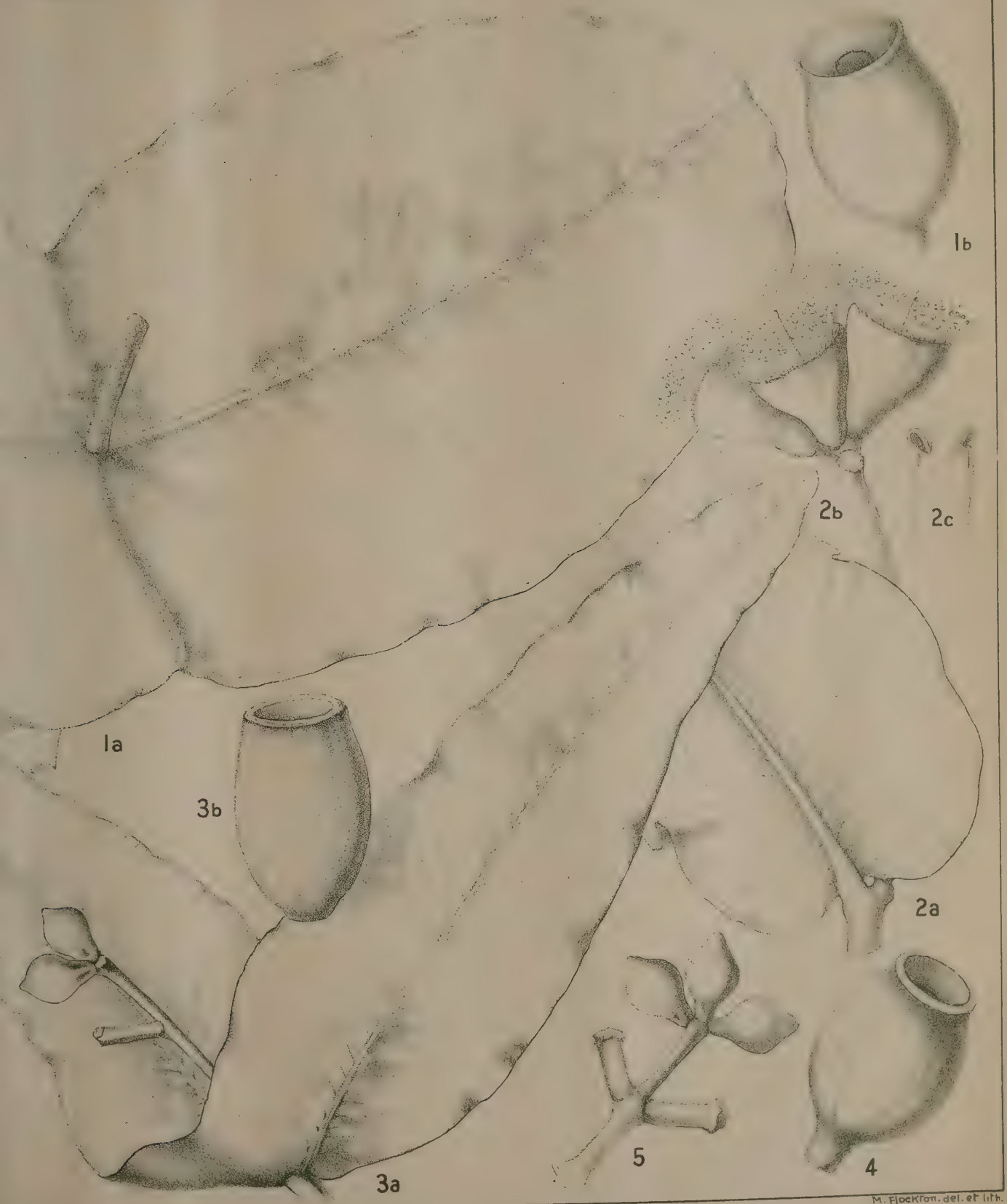
4*a*. Juvenile leaves (the oil-glands as prominent as those of *E. approximans* Maiden, see Plate 179, Part XLIII); 4*b*, anther; 4*c*, twig, bearing mature leaves and fruits. Ticketty Well, between the Gwydir and McIntyre Rivers, northern New South Wales (E. H. F. Swain, No. 42). The type.

5*a*. Broader, shorter leaf, from a fruiting twig; 5*b*, buds, seven in the head. Jericho, Queensland (J. L. Boorman.)

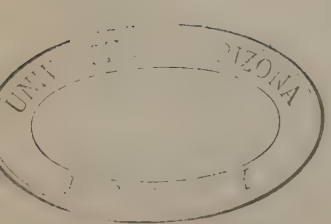
E. Jacksoni Maiden.

6*a*. Juvenile leaf; 6*b*, juvenile leaf, a stage more advanced; 6*c*, mature leaf; 6*d*, fruits. Deep River, Nornalup Inlet, South West Australia (Sid. W. Jackson). The type.

7. Twig with mature leaves and immature buds. Two miles from the Franklin River, on the Denmark, road, South West Australia (Dr. F. Stoward, No. 114).

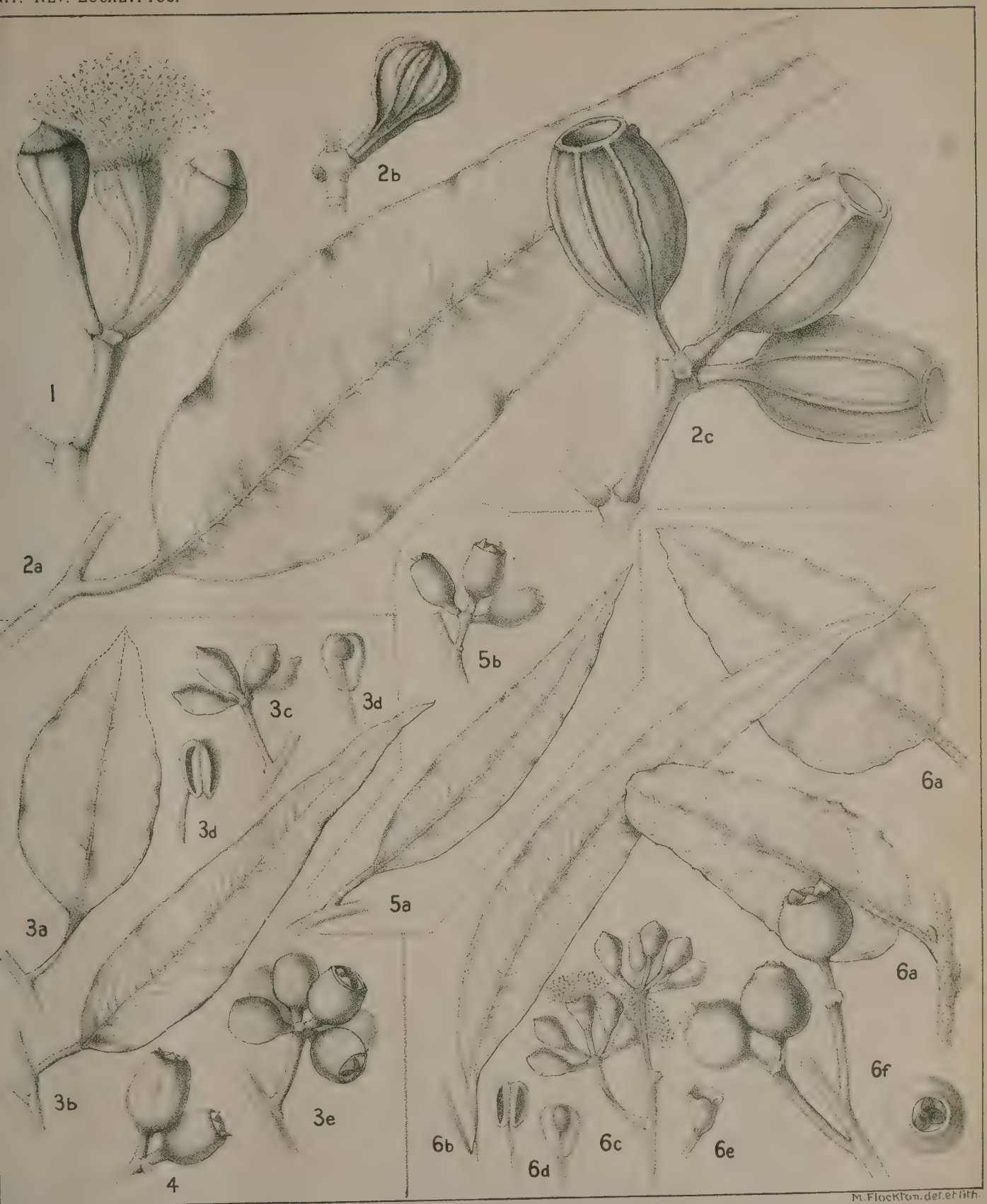


EUCALYPTUS PERFOLIATA R.BR.



EUCALYPTUS PTYCHOCARPA F.v.M. [See also Plate 182.]

ARIZONA



EUCALYPTUS PTYCHOCARPA F.v.M. (*1, 2*) [See also Plate 181.]

E. SIMILIS MAIDEN. (*3, 4*) E. LIRATA (W. V. FITZGERALD) MAIDEN. (*5*)

E. BAILEYANA F.v.M. (*6*)

EUCALYPTUS LANE-POOLEI MAIDEN. (*1*) [See also Figs. 4 and 8, Plate 74.]

E. EWARTIANA MAIDEN. (*2, 3*) [See also Fig. 11, Plate 74.]

E. BAKERI MAIDEN. (*4, 5*) E. JACKSONI MAIDEN. (*6, 7*)

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The following species of Eucalyptus are illustrated in my "Forest Flora of New South Wales"* with larger twigs than is possible in the present work; photographs of the trees are also introduced wherever possible. Details in regard to their economic value, &c., are given at length in that work, which is a popular one. The number of the Part of the Forest Flora is given in brackets :—

acacioides A. Cunn. (xlviii).
acmenioides Schauer (xxxii).
affinis Deane and Maiden (lvi).
amygdalina Labill. (xvi).
Andrewsi Maiden (xxi).
Baileyana F.v.M. (xxxv).
Baueriana Schauer (lvii).
Baueriana Schauer var. *conica* Maiden (lviii).
Behriana F.v.M. (xlvi).
bicolor A. Cunn. (xliv).
Boormani Deane and Maiden (xlv).
Bosistoana F.v.M. (xliii).
Caleyi Maiden (lv).
capitellata Sm. (xxviii).
conica Deane and Maiden (lviii).
Consideniana Maiden (xxxvi).
coriacea A. Cunn. (xv).
corymbosa Sm. (xii).
crebra F.v.M. (liii).
Dalrympleana Maiden (lxiv).
dives Schauer (xix).
dumosa A. Cunn. (lxv).
eugenioides Sieber. (xxix).
fruticetorum F.v.M. (xlii).
gigantea Hook. f. (li).
globulus L'Her. (lxvii).
goniocalyx F.v.M. (vi).
hæmastoma Sm. (xxxvii).
hemiphloia F.v.M. (vi).
longifolia Link and Otto (ii).
Luehmanniana F.v.M. (xxvi) (=*E. virgata*).
macrorrhyncha F.v.M. (xxvii).
maculata Hook. (vii).
melanophloia F.v.M. (liv).
melliodora A. Cunn. (ix).
microcorys F.v.M. (xxxviii).
microtheca F.v.M. (lii).
Muelleriana Howitt (xxx).
numerosa Maiden (xvii).
obliqua L'Hérit. (xxii).
ochrophloia F.v.M. (l).
odorata Behr. and Schlechtendal (xli).
oleosa F.v.M. (lx).
paniculata Sm. (viii).
pilularis Sm. (xxxi).
piperita Sm. (xxxiii).
Planchoniana F.v.M. (xxiv).
polyanthemos Schauer (lix).
populifolia Hook. (xlvii).
propinqua Deane and Maiden (lxi).
punctata DC. (x).
radiata Sieb., as *amygdalina* (xvi).
regnans F.v.M. (xviii).
resinifera Sm. (iii).
rostrata Schlecht. (lxii).
rubida Deane and Maiden (lxiii).
saligna Sm. (iv).
siderophloia Benth. (xxxix).
sideroxylon A. Cunn. (xiii).
Sieberiana F.v.M. (xxxiv).
stellulata Sieb. (xiv).
tereticornis Sm. (xi).
tessellaris F.v.M. (lxvi).
Thozetiana F.v.M. (xlix).
viminalis Labill (lxiv).
virgata Sieb. (xxv).
vitrea R. T. Baker (xxiii).

* Government Printer, Sydney. 4to. Price 1s. per part (10s. per 12 parts); each part containing 4 plates and other illustrations.

Sydney: William Applegate Gullick, Government Printer.—1904.

A Critical Revision of the genus Eucalyptus

BY

J. H. MAIDEN, I.S.O., F.R.S., F.L.S.

(Government Botanist of New South Wales and Director of the Botanic Gardens, Sydney).

Vol. V. Part 5.

Part XLV of the Complete Work.

(WITH FOUR PLATES.)

"Ages are spent in collecting materials, ages more in separating and combining them. Even when a system has been formed, there is still something to add, to alter, or to reject. Every generation enjoys the use of a vast hoard bequeathed to it by antiquity, and transmits that hoard, augmented by fresh acquisitions, to future ages. In these pursuits, therefore, the first speculators lie under great disadvantages, and even when they fail, are entitled to praise."

MACAULAY'S "ESSAY ON MILTON."

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CCLIII. Eucalyptus erythrocorys F.v.M.

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CCLVII. Eucalyptus Blaxlandi Maiden and Cambage.

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CCLVIII. Eucalyptus Normantonensis Maiden and Cambage.

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DESCRIPTION.

CCLIII. E. erythrocorys F.v.M.

In *Fragm.* ii, 33 (1860.).

FOLLOWING is a translation of the original description:—

Shrubby, leaves opposite, thickly coriaceous, long and narrowly lanceolate, somewhat falcate or slightly curved, imperforate, densely and spreadingly penniveined, with long petioles, the intramarginal vein somewhat distant from the edge; the peduncles thick, compressed, generally three-flowered, the calyxes large and sub-sessile, calyx-tube obpyramidate-tetragonous, plicate-costate, at the angles with a short apiculate tooth, several times longer than the scarlet operculum, depressed at the vertex, quadri-costate at the angles, swollen and wrinkled, fruits very large, very broadly campanulate, the top convex, deeply marked in front of the very rounded indentations of the margin, and broadly surrounding the orifice of the four-celled capsule; the valves red, converging, sunk below the vertex of the fruit, seeds winged.

At the Murchison River and toward Shark's Bay, in rocky plains.

A shrub 8–10 feet high, called "Illyarie" by the natives, by whom it is named on account of its ornamental character. Branches somewhat terete. Branchlets compressed-tetragonous, sturdy. Leaves of the same colour on both sides, shining, 3½ to 7 inches long, under ⅝ to 1 inch broad, slightly pointed at the base and very much so at the apex; veins prominent. Peduncles about 1 inch long. Buds about 1 inch long or slightly shorter, contracted towards the base. Calyx tube dark green, bicostate on each side, from whence it is somewhat plicate. Operculum twice as broad as deep, cinnabar-red from the observation of the finder, preserving the red colour remarkably when dried, sometimes with and sometimes without a small umbo. Filaments innumerable, the collector has observed them to be purple, in dry specimens in a young state they were yellowish-green and half an inch shorter. Limbs four, confluent; the peduncles very thick, semi-orbicular, corresponding with the sides of the calyx-tube. Anthers sub-ovate, bearing a conspicuous gland at the back of the apex. Pollen golden. Fruits about 1½ inch long and broad, twelve-ribbed, ribs confluent in threes at the apex; flat top of the width of the orifice, undulate, smooth; vertex of the capsule itself somewhat smooth, valves acuminate when contracted. Seeds 1½ to 2½ lines long, some are sterile and angular-clavate, others half renate or half-round or deltoid, always smooth; I have not seen ones bearing the embryo. One of the most magnificent species of the genus; it now seems to have been known to Drummond (compare Hooker, *Kew Misc.*, v, 121). I have hardly seen the flowers well opened; if the stamens, on the observation of Drummond, are collected in bundles of four, then the species should be added to the Eudesmieæ.

Drummond's earlier account is as follows:—

"A square-capsuled opposite-leaved Eucalyptus, not yet seen in flower, grows among the hills near Dundarangan; and a beautiful yellow-flowered Eucalyptus grows on the limestone hills to the west of the Valley of the Lakes; it grows to a tree from 20 to 30 feet high, the leaves resemble those of the Red Gum (*E. calophylla*), they are hispid on the young shoots, glabrous on the flowering branches, they are always opposite in vigorous growth, sometimes alternate on old stunted trees; the cups are of a bright scarlet colour, and have a verrucose appearance; when the capsule expands in a quadrangular form, the angles carry with them the stamens in four divisions; the seed-vessels are nearly as large as those of the Red Gum. The scarlet cups, fine yellow flowers, and opposite shining leaves of this tree make it one of the finest species of the genus." James Drummond in Hooker's *Journal of Botany*, vol. 5, p. 121, 1853.

From Bentham we learn that this description applies to Drummond's 6th Coll. No. 70, fragments of which I have figured at figs. 1*a* and 1*b*, Plate 184.

Bentham (B.Fl. iii, 258) re-described the species in the following words:—

A shrub of 8 to 10 (*Oldfield*) or a tree of 20 to 30 feet (*Drummond*). *Leaves* mostly opposite or nearly so, or the upper ones alternate, all petiolate, long-lanceolate or broadly linear, often above 6 inches long,

rigid, but with the oblique rather irregular veins conspicuous on both sides, the intramarginal one near the edge. *Peduncles* axillary or lateral, very thick, flat and broad, ½ to 1 inch thick, flattened pedicels. *Calyx-tube* turbinate, very thick, irregularly ribbed, ½ to ¾ inch long, and nearly ¾ inch diameter at the top, with four more or less prominent angles, terminating in exceedingly short, obtuse, scarcely prominent teeth. *Operculum* red, thick and fleshy, depressed and flat-topped, broader and shorter than the calyx-tube, obtusely square or almost four-lobed, divided into four quarters by raised ribs, forming a cross on the top, each quarter transversely wrinkled, with a raised rib along the centre, opposite to the calyx-teeth. *Stamens* very numerous, inflected, forming four bundles alternating with the calyx-teeth, the claw or entire part very short and broad, or four clusters if the claw be considered as a mere dilatation or lobe of the margin of the staminal disk. *Ovary* much depressed, flat-topped. *Fruit* nearly hemispherical, ribbed, 1 to 1½ inch diameter, the margin of the calyx horizontally dilated, the disk very broad and obtusely prominent, giving it the shape of an old-fashioned hat, the capsule depressed in the centre, the valves not raised.

Mueller redescribed it, with a figure, in his "Eucalyptographia." In that work he repeats that the filaments are sometimes purplish, thus adding it to the number of species with filaments of more than one colour.

"To the description should be added :—Juvenile leaves broader than the adult, margin very smooth, broadish and both sides and the branchlets stellato-scabrous.

"This species is often shrubby, but sometimes a tree of 10 metres, in calcareous coast-lands, it seems to be restricted to the Irwin district. Mueller's Eucalyptographia plate unsatisfactory." (Diels and Pritzel, *Engler's Jahrb.* xxxv, 444, 1905.)

The authors do not say in what respects Mueller's plate is unsatisfactory—perhaps in the absence of juvenile leaves which were, however, sent by Drummond, although apparently Bentham and Mueller did not see them. Probably they refer to the reduced scale of the drawing, which is thus calculated to mislead, and the plan of the flower, at figure 2, which does not show the stamens in bundles.

Following is the history of two out of several plants in the Botanic Gardens, Sydney, raised from Mr. W. D. Campbell's seed. We find it requires a sheltered situation to do well. Sown 10th October, 1913, seedlings drawn in various stages, planted out 11th May, 1914, flowered 12th April, 1917.

(*a*) 12 feet high and 7 inches girth at 3 feet from the ground (23/4/17). 19 feet 5 inches high, and 13 ft. 6 in. in girth (15/10/20).

(*b*) 16 feet high, and 7 inches girth at 3 feet from ground (23/4/17). 20 ft. 3 in. high, and 10½ inches in girth (15/10/20).

The following description is taken from fresh material from the above two small trees :—

Stems white, smooth. The mature leaves opposite, and the branchlets decussate. The inflorescence displays the most charming colour-scheme of any Eucalypt known to me. The axes or branchlets bearing the inflorescence are of a dull purple lake (see Dauthenay, Plate 170, shades 2–4). The long, flattened peduncles are moss-green (see Dauthenay, Plate 272, shades 1 and 2). The buds are handsome because of the large, fleshy, biretta-like opercula, of an old carmine red (see Dauthenay, Plate 107, shades 1 and 2), which contrast well with the rich, grass-green ribbed calyx-tubes (Dauthenay, Plate 273, shades 2–4). The inside of the large operculum is smooth and white, and the outside has four raised, cruciform ridges, the general surface being more or less rugose. The falling of the operculum is succeeded by the protrusion of filaments, at first greenish-yellow (primrose-yellow), and afterwards lemon or golden-yellow (see Dauthenay, Plate 16, shades 2 and 3). The staminal disc or ring being broad and white, it effectively contrasts the colours of the calyx-tube and filaments. See also p. 135, for a further account of the stamens and staminal ring.

The stigma is punctate and green, thus contrasting with the stamens. The top of the expanded flower shows a rim or hub round the base of the stigma (top of the ovary) and radiating from it, in the direction of the greatest widths of the staminal rings (greatest lengths of stamens) are four equidistant ribs or spoke-shaped processes which enclose four shallow troughs which are filled with honey and are therefore nectaries.

The inflorescence is alike bizarre and beautiful; the plant is most charming.

Fresh fruits sent to me from spontaneous trees by Mr. Campbell were up to 2¼ by 2¼ inches (therefore, much larger than those of the type), with sessile or rudimentary flattened pedicels.

Bundling or Tuftiness of the Stamens.

Robert Brown included "Stamens in four polyandrous bundles, alternating with the teeth of the calyx, connate at the base" as a character in his definition of *Eudesmia* as a genus distinct from *Eucalyptus*. He dropped the genus as untenable, later on, but Bentham (B.Fl. iii, 258) preserved the name to indicate a sub-series (IX) of Eucalyptus, which he called Eudesmieæ. His definition of the sub-series includes "Stamens *sometimes* (my italics) very shortly united in four clusters, alternating with the calyx-teeth."

The matter of grouping will be dealt with subsequently, at the proper place, but Miss Flockton has produced such an excellent figure (fig. 2*g*, Plate 184), of the bundling or apparent bundling of the stamens in a large-flowered species such as *E. erythrocorys* that a few remarks may be offered at this place. In the Eudesmieæ we have (so far as the material at our disposal permits us to judge) various degrees of bundling (compare fig. 3*c*, Plate 185, for another example, *E. tetrodonta*). *E. tetragona* and *E. eudesmioides* will follow in the next part.

In *E. erythrocorys*, the white staminal ring (which is ultimately deciduous) is undulate on both margins, becoming wider at the crests or tops of each undulation, of which there are four, and becoming narrowest in each trough. An effect of the narrowness of the staminal ring at the four troughs is that there is a diminution of the number of stamens, since there is less room for them, and thus an appearance of tuftiness or bundling is caused. As a matter of fact there is not, at all events, at the period of the fall of the operculum, any complete break in the continuity of the stamens, though, as the flower develops, there is some deciduousness where the trough is deepest. If therefore the use of the word "bundle" or "tuft" means a complete break in the continuity of the stamens, it is incorrect, but there certainly is an *appearance* of bundling.

Further, there is variation in the lengths of the filaments, the longest emerging from the crests of each undulation and the shortest at the troughs. This character increases the appearance of tuftiness of the stamens.

It may be convenient at this place to contrast the stamens of five species of Eudesmieæ where I have adequate stamen-material. The material of the other species is not so satisfactory.

E. erythrocorys (see Plate 184, this Part). The stamens are in four bundles, usually quite round the undulating staminal ring, but there are not so many in the trough, nor so long as those on the crest. The outer row expands last, in the following species the inner row expands last.

E. tetrodonta (see Plate 185, this Part). The stamens are in four bundles, but are disposed round the staminal ring , which is not undulate in this case.

E. tetragona (see Plates 188, 189, Part XLVI). The stamens are in four bundles on an undulating staminal ring, with a distinct gap between the four clumps. This species is especially interesting because it is that on which the genus *Eudesmia* was founded.

E. eudesmioides (see Plate 189, Part XLVI). The stamens are in four bundles on an undulating shallow staminal ring. There is a gap without stamens between each pair of bundles.

As regards *E. tetragona* and *E. eudesmioides*, the stamens appear to have thinned out or disappeared where the staminal ring becomes narrowest at the troughs. Speaking generally, as regards the Eudesmieæ, whether the ring is of varying thickness or not, the stamens appear to thin out at four parts of the periphery.

E. Baileyana (see Plate 182, Part XLIV, where, however, the stamens are not shown in the mass). The stamens are in four distinct bundles right round the staminal ring, although more deciduous between the bundles.

RANGE.

It is confined to Western Australia. The type was collected " at the Murchison River, towards Shark's Bay, in rocky plains," by Oldfield.

In " Eucalyptographia " its range is defined as " In stony undulating bushy country between the Irwin River and Shark Bay, rather rare." " Not observed nearer (to Shark's Bay) than 20 miles south of Freycinet Harbour. The plants indigenous around Shark's Bay and its vicinity." (Mueller, Parliamentary Paper, W.A., 1883, p. 14.)

This would bring it not many miles north of the Murchison River, and it would be desirable to enquire into its limits more accurately, which are at present recorded as 10 miles south of Dongarra (which is at the mouth of the Irwin River) on the Arrowsmith road in the south, and 20 miles south of the Freycinet estuary in the north. We do not know its eastern boundary. If Drummond's Dundaragan be identified, as it seems to be, with the modern Dandaraga, then the southern boundary is removed to say, the Moora district, Moora being a railway station 108 miles north of Perth. It would be very desirable to obtain more accurate information in regard to the range of one of the most interesting species of the genus.

I have seen specimens of Drummond's No. 70 (6th Coll.) in Herb. Calcutta and Herb. Cant. " Limestone Hills, west of the Valley of the Lake," which is, of course, near Dundaragan, as already quoted from Drummond's original letter. This place has been already referred to. I have also seen it from the Murchison River, in Herb. Barbey-Boissier, collected by Oldfield.

"Tree of about 25 feet, rather straggly, has white bark, looks like a white gum but is slightly different. The pink buds look peculiar." Arrowsmith-road, about 10 miles south of Dongarra (W. D. Campbell).

AFFINITIES.

With *E. megacarpa* F.v.M.

"Among Eucalypts, it resembles *E. globulus* on account of the shape of the bud. The latter species appears also to grow in the humid tract of land on the coast of south-west Australia near Cape Leeuwin, as far as it is possible to judge from the specimens of our carpological collection." (N.B.—This was an error, the globulus-like species being *E. megacarpa* J.H.M.). (Original description.)

"It differs widely from the few other species of that section (*Eudesmia*) in the large size of its flowers and fruits, in the shape and coloration of the lid, as well as in the very broad expansion of the summit of its fruit, irrespective of some less conspicuous differences." ("Eucalyptographia.")

It is convenient to have a small table of characters illustrating all the Eudesmieæ, as follows. The number preceding each species-name indicates the Part of this work in which it has or will be treated.

	44. *Baileyana.*	45. *tetrodonta*	45. *odontocarpa.*	44. *similis.*	44. *lirata.*	46. *eudesmioides.*	46. *tetragona.*	45. *erythrocorys.*
	Eastern Species.			Eastern Species.				
Size ...	Medium-sized tree or larger. "Black Stringybark."	Medium-sized tree to very large. "Messmate."	Shrub ...	Medium-sized tree. "Yellow Jacket."	Medium-sized tree.	A shrub or small tree up to 20 feet. "WhiteGum"	Tall, glaucous shrub or small tree. "White Marlock."	Tall shrub or small tree. Branches decussate.
Bark ...	Hard, thick, fibrous, interlocked. A coarse stringybark.	Whitish, fibrous, persistent.	.....	Yellow flaky ...	Rough and greyish, soft and friable.	Smooth, a little scaly at butt.	Smooth, a little scaly at butt.	Smooth, with a little ribbony bark.
Timber	Pale brown ...	"Pale" (W.V.F.), "Reddish-brown" (R.H.C.)	.....	.....	Brownish ...	Pale-chocolate brown towards heart; most of it white.	Pale	Pale brown.
Leaves	Broadly-lanceolate.	Long-lanceolate. Huge juvenile leaves.	Linear-lanceolate.	Ovate acuminate, then narrow lanceolate.	Lanceolate ...	Lanceolate ...	Reek with oil ...	Very large.
Flowers	Filaments cream-coloured.	Buds reminiscent of large cloves. Filaments yellowish-white.	.....	Filaments yellow.	.....	Filaments cream-coloured.	Filaments cream-coloured.	Very large filaments primrose yellow. Opercula carmine-red.
Fruits	Nearly globular	Oblong-cylindrical.	Oblong-cylindrical (smaller than preceding).	Truncate-ovoid	Truncate-ovoid perhaps larger and more globular than *similis*.	Quadrangular	Ovoid to nearly globular. Rather large.	Tetragonous, quadrangular, 2¼ x 2¼ inches. Largest fruit in genus.

Thus we have one purely eastern species (*Baileyana*), one eastern species (*similis*) which probably will be found further west. Confined to the tropics are *tetrodonta*, *odontocarpa*, and *lirata*. Sub-tropical Western Australia has *eudesmioides*, *erythrocorys*, and *tetragona*, of which the first two are true west and the last south-west; the first is inland (approaching the coast), the last two are coastal.

Apparently the largest tree is *E. tetrodonta*, but *E. Baileyana*, *E. similis* and *E. lirata* are fairly large trees. *E. tetragona* and *E. erythrocorys* are tall shrubs or small trees, while *E. odontocarpa*, of which we know very little, has hitherto only been recorded as a shrub. The branchlets of all are quadrangular. *E. Baileyana* and *E. tetrodonta* are more or less fibrous-barked, the former being the more stringy. *E. eudesmioides*, *E. tetragona*, and *E. erythrocorys* are Gums, while *E. similis* is a Yellow Jacket, and *E. lirata* may prove to be so.

The leaves of all are opposite or sub-opposite, thus showing affinity to *Angophora*, though in the fruits the latter genus more closely resembles the Angophoroideæ section of Eucalyptus. The Eudesmieæ have interesting affinities, but a fuller discussion of them must be deferred until the affinities of the whole of the species are dealt with.

E. tetragona stands out because the leaves reek with oil, and because of its glaucousness.

Speaking generally, the filaments are arranged in four bundles or tend to be so; the filaments are yellowish white or yellow, those of *E. erythrocorys* being bright primrose yellow, *E. Preissiana* being the only species that can approach it in this respect. The opercula of *E. erythrocorys* are unique in that they are shaped like a biretta, and are of a rich carmine-red colour.

The buds of *E. tetrodonta* and *E. odontocarpa* are reminiscent of cloves, the former being the larger.

The outstanding characters of the fruit are brought out in the table, the huge fruits of *E. erythrocorys* (the most remarkable species amongst the Eudesmieæ) and the smaller globular fruits of *E. Baileyana*, being perhaps the most striking.

DESCRIPTION.

CCLIV. E. tetrodonta F.v.M.

In *Journ. Linn. Soc.*, iii, 97 (1859).

FOLLOWING is a translation of the original :—

A tree with angular branchlets, *leaves* opposite, falcate-lanceolate, gradually acuminate, moderately petiolate, opaque, indistinctly penniveined, peripheral vein rather close to the margin, *umbels* axillary, terminal, solitary, bibracteate, three-flowered ,*bracts* slowly falling off, rather large, the angled *peduncle* the same length as the *petiole*, *calyx* sub-campanulate, quadridentate, gradually narrowed into a compressed *pedicel* which is barely the same length as the tube, teeth deltoid, *operculum* hemispherical, and the tube and spreading teeth twice as long as the operculum.

In woody elevated less fertile tracts everywhere in Arnhem's Land. (At Port Essington, *Armstrong*, and on the North Coast, *A. Cunningham* in herb. Hook.) Flowering in August and September.

A medium-sized tree with a straight slender trunk, with a dirty grey fibrous bark persisting all over. With bark of " Stringybark trees." Branchlets reddish, rigid. Leaves 3–6 inches long, ½–1½ inches broad. peduncles 3–4 lines long, bearing at the apices two cymbiform, lanceolate, obtuse, acuminate bracts, about 3 lines long, deciduous. The tube of the calyx with the teeth, 4–5 lines long. Operculum coriaceous, obtuse, opaque, greenish. A species especially remarkable for the toothed calyx, showing transit to *Angophora*.

Bentham (B.Fl. iii, 260) then described it in the following words :—

A tree, with a whitish, fibrous, persistent bark (*F. Mueller*). *Leaves* opposite or alternate, long-lanceolate, acuminate, often falcate and above 6 inches long, coriaceous, but the numerous somewhat oblique veins prominent, the intramarginal one near the edge. *Peduncles* axillary or two or three together at the ends of the branches, short and thick but not dilated, each bearing three or very rarely five rather large flowers, on thick angular or flattened *pedicels* of 2 to 4 lines. *Calyx-tube* obconical or turbinate, 3 to 4 lines long, wtih four rounded very obtuse teeth, slightly prominent on the bud. Operculum hemispherical or nearly globular, smooth. Stamens very numerous, the longest attaining 5 or 6 lines, not distinctly arranged in clusters; anthers oblong, with parallel cells opening longitudinally. *Ovary* flat-topped. *Fruit* oblong-cylindrical, ½ to ¾ inch long, 4 to 6 lines diameter, not contracted at the orifice, the rim narrow but forming an acutely prominent ring, the capsule sunk, usually three-celled.

Mueller subsequently redescribed it and figured it in " Eucalyptographia."

In this work he speaks of it as " not tall " and " stem rather slender," and in the original description as a " meduim-sized tree." It will be observed that, as regards the Northern Territory, it is described as " exceedingly well developed and reaching very large size, 70 or 80 feet or more and 3 feet or more in diameter." It is evidently one of the most important timber trees of the tropics, and it is desirable that we should know more of its distribution and abundance.

Mr. W. V. Fitzgerald (MSS.), speaking of Kimberley, says: " Tree of 40–50 feet, trunk to 25 feet, diameter 1–1½ feet; bark persistent on stem and branches, greyish, fairly rough, and very stringy; timber pale, fissile, moderately hard; filaments yellowish-white."

Mr. R. H. Cambage, speaking of North Queensland, says (*Proc. Roy. Soc. N.S.W.*, XLIX, 414, 1915):—

This species, which was the only Eucalypt met with belonging to the sub-series Eudesmieæ, is a very interesting one, for in addition to being one of the few having calyx teeth, like the Angophoras, it is apparently the only stringybark to be found in Northern Australia, excepting in the extreme east. It is known both as Messmate and Stringybark, and its bark is decidedly fibrous, the timber being reddish-brown. . . . The "sucker" leaves are opposite or alternate, ovate to ovate-lanceolate, up to 7 inches long by 3 to 4 inches broad, with petioles of half to three-quarters of an inch long, the lateral veins being arranged at an angle of about 60 degrees with the midrib, the intramarginal vein being close to the edge, the midrib prominent on the upper side of the leaf, the young leaves often reddish. The trees, which are erect, have an average height of about 40 feet with a diameter of about 1 foot, and prefer siliceous soil.

There is a discrepancy in the colour of the timber as given by Fitzgerald and Cambage, but anyone who has given much attention to Stringybark timber in general knows how it varies in colour according to the district, and as the tree is large or small and the specimen fresh or dry.

I overlooked Mr. Cambage's earlier description of the juvenile leaves, or I would not, in the following passage, have stated that they had hitherto not been described.

Juvenile leaves of this species have been received from Darwin from Dr. Jensen (July, 1916), and have not hitherto been described. I proceed to describe them.

The branchlets are markedly quadrangular, and like the leaves are entirely glabrous or very slightly glaucous, and equally green on both sides. They are large, oblique or falcate, very acuminate with prominent purplish midribs, raised chiefly on the lower sides of the leaves.

Secondary veins very distinct, but fine, roughly parallel, and making an angle of about 60 degrees with the midrib. The intramarginal vein is at a considerable distance from the edge.

A not uncommon size of the lamina is 25 cm. (say 10 inches) long and 13 cm. (say 5 inches) broad, with a petiole of 1·5 cm. Still in the opposite stage they may be half the width. (Maiden in Ewart and Davies' "Flora of the Northern Territory," p. 314, 1917.)

The flower buds are strongly reminiscent of large cloves, the opercula are ribbed, the ribs being occasionally almost winged.

"*E. tetrodonta* would probably merge into the division of Pachyphloiæ, which comprises all the Stringybark trees." ("Eucalyptographia.")

RANGE.

The type came from the entrance to the Victoria River and the elevated sterile districts of Arnhem's Land, "Stringybark." (Mueller.) These are, of course, Northern Territory.

Bentham adds "North Coast," *A. Cunningham*, and Port Essington, *Armstrong*. Mueller ("Eucalyptographia") adds to these Port Darwin, Maria Island and Liverpool River and Escape Cliffs. All the localities so far quoted are Northern Territory, unless Cunningham's be tropical Western Australia.

But Mueller has definitely reported it from Tropical Western Australia (Prince Regent's River), while we have abundant localities from Northern Queensland. So that

its range may be at present stated as from the most northern tropical portion of Australia, extending from the West Kimberleys in Western Australia along the Northern Territory to North Queensland.

Western Australia.

Mueller first recorded the species from Western Australia from the Prince Regent's River, collected by Bradshaw's Expedition. See *Proc. Linn. Soc. N.S.W.*, xvi, 469 (1891).

Subsequently W. V. Fitzgerald reported " A small forest of Messmate or Stringybark was observed in sandy loam and among quartzites on the Packhorse Range." (Kimberley Report, p. 12, 1907.)

Some of his specimens are labelled " Messmate Creek (presumably named after this tree), Packhorse Range," and Packhorse Range generally. (W. V. Fitzgerald, No. 1,214.) The locality is, of course, considerably south of the Prince Regent's River. Mr. Fitzgerald (MSS.) adds Charnley River in West Kimberley, and says it is called " Messmate " and " Stringybark," and that it is found in sandy soil overlying quartzite and sandstone.

Northern Territory.

It is frequently referred to as " Stringybark " by Leichhardt in his " Overland Expedition from Moreton Bay to Port Essington." It is the Stringybark of the Gulf Country, and he notes it both in what is now Northern Queensland and the Northern Territory. I have seen a specimen of his labelled " West Coast of the Gulf." Dr. H. I. Jensen says, in a letter to me, " Stringybark occurs, as in the Northern Territory, on poor sandy granite and sandstone soils, but not abundantly."

The following specimens are before me :—

Bathurst Island (G. F. Hill, No. 466); Melville Island (Prof. Baldwin Spencer); Darwin (Nicholas Holtze, Prof. Baldwin Spencer).

" The common Stringybark from Port Darwin to inland slopes, several hundred miles from the coast. Always on poor soil—coastally rather stunted in porcellanite and laterite formation. At the Adelaide River, Stapleton, Batchelor, and in the hill belt generally, exceedingly well developed and reaching very large size, 70–80 feet or more high, and 3 feet or more in diameter on granite, quartzite, and sandstone." (Dr. H. I. Jensen.) (G. F. Hill, No. 340.)

" Large Eucalypt, hard wood." Batchelor Farm (C. E. F. Allen, No. 224). " Stringybark Box, white flower," Pine Creek (Dr. H. I. Jensen). Pine and Horseshoe Creeks (E. J. Dunn and R. J. Winters).

Edith Creek and track generally to Katharine River (Prof. Baldwin Spencer).

Speaking generally, but with especial reference to Darwin, Dr. Jensen writes: " On the granite country we get Stringybark (*E. tetrodonta*), Bloodwood (*E. latifolia*), *E. setosa*, Salmon Gum (?), Ironwood (? *Tristania suaveolens*), *E. miniata*, and patches, of *E. phœnicea*."

QUEENSLAND.

Following are some localities of specimens I have seen, and with the greater settlement in Queensland, as compared with the remainder of the tropics, I look for additional localities, in order that its range may be better defined.

Sources of the South Coen River (Stephen Johnson, in Melbourne Herbarium). This is, of course, in the Cape York Peninsula, and the most northern Queensland locality recorded.

Stewart River (Stephen Johnson).

This is the species referred to by Leichhardt as Stringybark, and noted at various points from the upper Lynd right to the settlement at Port Essington.

Walsh River (correspondent of F. M. Bailey). Mitchell, Gilbert, and Norman Rivers (E. Palmer).

" Messmate," " Fibrous or stringybark on trunk and large branches, 40–50 feet." Little River, between Gilbert River and Croydon (R. H. Cambage, No. 4,005).

It was first noticed between the twenty-second and twenty-fourth mile posts from Alma-den, and again towards the fifty-first mile post. It was subsequently seen at various points along the Gilbert River, at the changing station on the Little River, and around Normanton. (R. H. Cambage in *Proc. Roy. Soc. N.S.W.*, xlix, 413, 1915.)

Referring to Leichhardt's " Overland Expedition to Port Essington," at p. 279 (*op. cit.*), he speaks of the koolimans of the natives being " very large, almost like small boats, and (were) made of the inner layer of the bark of the Stringybark tree." At p. 285, " The Stringybark grew to a fine size on the hills, and would yield, together with Ironbark, and the Drooping Tea-tree, the necessary timber for building." At p. 291, " All along the Lynd we had found the gunyas of the natives made of large sheets of Stringybark, not, however, supported by forked poles, but bent, and both ends of the sheet stuck in the ground." They found them frequently afterwards during the journey round the Gulf.

AFFINITIES.

1. With *E. odontocarpa* F.v.M.

" . . . this, however, I found only of shrubby growth, its leaves much narrower, the calyces very considerably smaller on shorter and thinner stalklets, the fruit also of much less size, its minute teeth protruding beyond the outward not decurrent rim." (" Eucalyptographia," under *E. tetrodonta*). See also under *E. odontocarpa* at p. 145.

2. With *Angophora*.

" . . . the strongly toothed calyx demonstrates some transit towards *Angophora*, although the lid is no ways dissolved into petals as in that genus, nor can the operculum be rightly regarded as petaloid, it being quite of the texture and structure normal in most Eucalypts, indeed, in this respect not different from the lid of *E. Preissii*, *E. terminalis*, *E. Abergiana*, and a few other species, in which the calyx is rather irregularly ruptured than circumcised by a clearly defined sutural line; at best only the inner layer of the lid could be assumed to be corollaceous, but it is closely connate with the outer stratum as usual in the genus." (" Eucalyptographia.")

The relations of the Eudesmieæ to *Angophora* will be treated at greater length in my grand classification of the various species of Eucalyptus.

DESCRIPTION.

CCLV. E. odontocarpa F.v.M.

In *Journ. Linn. Soc.*, iii, 98, (1859).

Following is a translation of the original :—

A shrub with angled branchlets; *leaves* opposite, rather shortly petiolate, linear or narrow-lanceolate, sub-falcate, acute at the base, shining, covered with bright dots, penniveined and reticulately veined, peripheral vein slightly distant from the margin ; *umbels* axillary, not exceeding three flowered, shortly pedunculate; the obconical acute quadridentate *tube* of the shortly pedicellate calyx three times as long as the depressed hemispherical *operculum*; *fruits* ovate-obconical indistinctly costate, quadridentate, trilocular, valves inserted below the margin.

In sandy desert near Sturt's Creek, flowering in autumn.

Shrub of 8–10 feet. Branches rather slender. Leaves 2–5 inches long, 3–6 lines broad. Umbels sometimes two, one of the depauperate. Fruits 3–4 lines long, shining.

It was next described in English by Bentham, in B.Fl. iii, 260 :—

A shrub of 8 to 10 feet, with slender branches (*F. Mueller*). *Leaves* opposite or alternate, linear-lanceolate, mostly 3 to 5 inches long, with oblique anastomosing veins, inconspicuous at first, more prominent in the fruiting specimens, the intramarginal one near the edge. *Peduncles* axillary, short, each with three small flowers on short pedicels, but not seen expanded. *Calyx-tube* in the bud narrow-turbinate, about 2 lines long, with four small, but prominent, spreading teeth. *Operculum* hemispherical, very obtuse. *Stamens* apparently not in clusters; anthers small, with parallel cells. *Fruit* oblong-cylindrical, 4 to 5 lines long, not contracted at the orifice when fully ripe; rim narrow, concave, the capsule slightly sunk, three or four celled.

It was not included in the "Eucalyptographia," but under *E. tetrodonta* it is stated that well developed flowers (of *E. odontocarpa*) are unknown.

RANGE.

On a drawing of a portion of the type the words "Sturt's Creek, Desert, February, 1856, Ferd. Mueller." This is in the Northern Territory, in about 18 degrees south latitude.

It also occurs in north West Australia (West Kimberley), also in desert.

Northern Territory.

"Small tree (Mallee)." Tanami Goldfield. (Dr. H. I. Jensen; C. E. F. Allen's No. 202.)

See also the Sturt's Creek locality already given for the type.

WESTERN AUSTRALIA.

" Desert south of Fitzroy River, West Kimberley." (W. V. Fitzgerald.)

This is one of Mr. Fitzgerald's labels, and his discovery of this species as new to Western Australia does not appear to have been recorded. It will be observed that, like Mueller, he speaks of it occurring in a " desert."

AFFINITIES.

1. With ***E. eudesmioides*** F.v.M.

E. odontocarpa is " very much like some specimens of *E. eudesmioides*, but the stamens do not appear to be arranged in clusters." (B.Fl., iii, 260.)

The affinities of the various species of the Eudesmieæ are dealt with at p. 137. The morphology of the filaments in the various species is discussed separately at p. 135.

2. With ***E. tetrodonta*** F.v.M.

E. odontocarpa ". . . at once distinguished from the following species (*tetrodonta*) by the very much smaller flowers." (B.Fl., iii, 260.) Luehmann (*Proc. Aust. Assoc. Adv. Science*, vii, 524) thought *E. odontocarpa* is probably a variety of *E. tetrodonta*. The species are compared to some extent in the table at p. 137.

3. With ***E. tetragona.***

" *E. tetragona* is through *E. eudesmioides* also cognate to *E. odontocarpa*, of which well-developed flowers remained as yet unknown; the differences of the latter consist in still narrower and somewhat curved leaves with more spreading veins, in the smallness of its flowers with proportionately more developed calyx-teeth, and the not membranously margined seeds; very possibly its anthers will bring it nearer to *E. tetrodonta*." (" Eucalyptographia.")

See the table at p. 137. *E. tetragona* and *E. eudesmioides* will be dealt with in Part XLVI.

DESCRIPTION.

XVII. E. capitellata Smith.

In " A Specimen of the Botany of New Holland," p. 42, 1793 (1794).

THE original description will be found at Part VIII, p. 211 of the present work. It was at this place more fully described by me, but my definition of the species, while largely following Bentham, Mueller and other competent authorities, was too wide. My references at *Proc. Roy. Soc. N.S.W.*, lii, 493 (1918), were also too inclusive, as they include the dwarf form that I separated under the name *E. Camfieldi*. (See *Proc. Roy. Soc. N.S.W.*, liv, 66, 1920); see also below, p. 149.

The type from Port Jackson may be described as follows:—

A small to medium-sized tree with a stringy bark and timber brown or pale brown in colour, the young branchlets sometimes almost quadrangular.

Juvenile leaves with undulate margins and a few stellate hairs when quite young, but developing later into a glabrous leaf of thicker texture of much larger size, ovate to orbicular (say 8 by 8 cm. and 8 by 10 cm., and even greater dimensions), shortly pedunculate or almost sessile, secondary veins few, spreading or looped, the intramarginal vein far removed from the edge.

Mature leaves " ovate lanceolate, firm, astringent but not very aromatic." (Original description.) Equally green on both sides; coriaceous, venation spreading.

Buds.—The buds and peduncles somewhat thick and angular or flattened. " We have seen no other species in which the flowers stand in little dense heads, each flower not being pedicellated so as to form an umbel." (Original description.) This, of course, does not remain true now.

Fruits.—In consequence of the fruits being sessile, or nearly so, and crowded into heads, these assume a polygonal shape at the base, as if they had been pressed together when in a plastic condition. With this exception, the fruits have the form of a very much compressed spheroid, the horizontal diameter of which is from one and a half times to twice the depth. The fruit is swollen out below the rim, which is sometimes very well defined, and of a red or brown colour. The fruit is sometimes truncate, but more frequently the rim is dome-shaped. There is great variability in the amount of exsertion of the valves. The fruit may be perfectly ripe without exserted valves, but a twig from the same tree may have them exserted.

The type came from Port Jackson (Sydney), N.S.W.

A figure of the species will be found at Plate 106, Part XXVIII, of my " Forest Flora of New South Wales "; figure B of that Plate belongs to *E. Camfieldi* Maiden. In the present work it is figured at Part VIII, Plate 37, figures 1, 2, 3, 5, 6, 7, so that the figures of the juvenile and intermediate leaf (4*a*, 4*b*) in Plate 186 seem quite adequate. The juvenile leaves of the two species can be compared.

RANGE.

This species is confined to New South Wales, so far as we know at present.

It occurs in poor, sandy land from Sutherland, near Port Hacking, a few miles south of Sydney, northerly to Port Stephens, and north of that it is found in certain New England localities indicated below. It is quite obvious that additional southern localities will be found, and intermediate ones between Port Stephens and Walcha.

While it seems to prefer coastal localities, it will be seen that it occurs on the northern tableland also. Indeed, the range of the species requires to be carefully ascertained.

Following are some localities, travelling north :—

Sutherland (J. L. Boorman). Woronora (F. W. Wakefield, No. 4). Kogarah, Oatley, Como and Hurstville (J. H. Camfield). Folly Point, Middle Harbour (D. W. C. Shiress).

George Caley's specimens in the British Museum, " Twisted Stringybark, near Sydney, January 15th, 1807, capitellata." (All in Caley's handwriting). Also British Museum, Nos. 15 and 5 from Dr. A. B. Rendle, F.R.S., Keeper of Botany, British Museum, 1912.

Corner of Pittwater and Spit roads, 20–50 feet high; also Common from St. Ives to Tumble Down Dick, a distance of about 5 miles (W. F. Blakely and D. W. C. Shiress.)

Passing Broken Bay, the following coastal specimens are strictly typical :—

Brisbane Water (W. D. Francis). Wyong (Forester F. G. McPherson). Morissett (A. Murphy). " Bark deeply furrowed, timber good." " This species has always yellow inner bark," Wyee (A. Murphy); Wallsend (W. W. Froggatt); Port Stephens district (A. Rudder); South Head of Port Stephens (J. L. Boorman).

The most northerly locality from which we have it is the Round Mountain, Guy Fawkes Range, 4,250 feet above the sea, and about 50 miles east of Armidale, on the Grafton road (J.H.M.). Buds as compressed as it is possible for them to be. Fruits large and hemispherical (figured at 7*a* and 7*b*, Plate 37). From the material available there may be room for opinion as to whether this is *E. capitellata* or *E. macrorrhyncha*, but the buds, at least, incline me to the view that it is *E. capitellata*.

(*a*) Near Apsley Falls, Walcha, No. 1,217, R. H. Cambage (E. C. Andrews), is identical with the preceding.

(*b*) Fourteen miles east of Deepwater at 4,000 feet, No. 1,219, Cambage (E. C. Andrews). In intermediate foliage only, but doubtless identical with the preceding.

(*c*) Near Swamp Oak, Walcha, No. 1,218, Cambage (E. C. Andrews), has a very short pedicel and is one of the specimens which show how difficult, and perhaps impossible, it is to say what line of demarcation there is between *E. capitellata* and *E. macrorrhyncha*.

DESCRIPTION.

CCLVI. E. Camfieldi Maiden.

In *Journ. Roy. Soc. N.S.W.*, LIV, 66 (1920).

Following is the original description :—

Frutex vel arbor pumila fere Mallee similis, statu immaturo pilis stellatis vestitis, cortice fibrosa; foliis junioribus scabrissimis, pilis stellatis dense vestitis, parvis, cordatis vel orbicularibus, saepe emarginatis; foliis maturis coriaceissimis, nitentibus, oblongis vel late lanceolatis, obliquis, apice obtuso; alabastris ca. 9 capitulo, sessilibus pedunculo breve, angulatissimis sed post anthesin ovoideis; antheris reniformibus; fructibus hemisphaericis ad 1 cm. diametro in capitulis, compressis, capsula 4-loculare, apicibus distincte exsertis.

A low branching shrub or stunted tree, almost Mallee-like and under 12 feet in height, and with stems about two inches in diameter. Covered with stellate hairs when young. Bark scaly-fibrous or fibrous, flattish, tough—a Stringybark.

Juvenile leaves very scabrous, abundantly provided with stellate hairs in the earliest stage, cordate to orbicular, often emarginate, never lanceolate in the young state. Often 2 cm. by 2 cm. with intermediate sizes up to 4 cm. by 4 cm. (They remind one irresistibly of *Angophora cordifolia*, and when small as well as young, of *Correa speciosa*.)

Mature leaves remarkably coriaceous and oblong to broadly lanceolate, with a blunt point, oblique, lustrous or shiny, as if varnished. Up to 1 dm. long, and, say, 3·5 cm. broad. Oblique and coarse in the intermediate stage with a mucro.

Buds about nine in the head, small, very angular through compression, becoming ovoid or scarcely angular on anthesis, sessile on a short peduncle or none. Anthers renantherous, but not typically so.

Fruits hemispherical, up to 1 cm. in diameter, in heads, compressed, sometimes so much so that they are almost syncarpous, with a shiny dark-red rim, capsule four-celled with the tips distinctly exsert.

The type is from Middle Harbour, Port Jackson, 25th May, 1897. Julius Henry Camfield, for many years Overseer of the Gard n Pa'ace Grounds, Botanic Gardens, Sydney, who died 26th November, 1916, was not only an excellent gardener, but a competent botanist, and I have much pleasure in dedicating this interesting species to his memory.

RANGE.

On exposed situations on sandstone tops, only known at present between Broken Bay and George's River, a few miles north and south of Port Jackson, New South Wales. There is little doubt that careful search will greatly extend the range. Following are specific localities :—

About half a mile south of the 17-mile post on the Galston road from Hornsby (W. F. Blakely). The west side of Berowra Creek, Hornsby, or about one and a half miles from the 17-mile post above.

Eight to 9 feet high, in low Honeysuckle (*Banksia*) Scrub, Willoughby (A. G. Hamilton). Near the Suspension Bridge, Willoughby (J. L. Boorman). " Looks like *E. capitellata*. From very stunted trees (very likely saplings from old stumps), only a few feet high. Note the sucker leaves." On the high ground of Middle Harbour (J. H. Camfield, 25th May, 1897). Northbridge, opposite the Spit (D. W. C. Shiress). Mosman (W. M. Carne).

The following are south of Port Jackson :—

Woronora River at Heathcote (J.H.M. and J. L. Boorman). A dwarf form, 8 feet high, Waterfall (R. H. Cambage, No. 4,169).

AFFINITY.

With ***E. capitellata*** Sm., with which it has long been confused.

E. capitellata is a tree, sometimes a large tree, and the organs are all larger, while there is an absence, or almost absence, of stellate hairs in the young shoots. *E. Camfieldi* is a Mallee-like plant, forming a dense undergrowth, from three to about twelve feet high. *E. capitellata* appears to be absent from the Hornsby district, where the new species is not rare. The juvenile leaves (suckers) of *E. Camfieldi* are smaller, more orbicular to cordate, scabrous with a persistent stellate tomentum, apparently always present around the base of the adult plants, forming thickets, similar to the low stunted forms of *Angophora cordifolia*. They are never lanceolate like those of *E. capitellata*. The new species has buds smaller than those of *E. capitellata*, and less attenuate, usually ovoid; in some specimens they are almost round and devoid of angles. The common peduncle is shorter than in *E. capitellata* and quadrangular to nearly terete. The peduncle of *E. capitellata* is very often more compressed in the early bud. The fruits are smaller than those of *E. capitellata*, but otherwise very similar.

The juvenile foliage shown in figures 4*a* and 4*b*, Plate 37, Part VIII, of this work (under *E. capitellata*), and also figure B, Plate 106, Part XXVIII, of my " Forest Flora of New South Wales," belong to *E. Camfieldi*.

It is the form (*b*), for the most part, of p. 493 of *Journ. Roy. Soc. N.S.W.*, LII, 1918.

Mr. Blakely has pointed out to me that *E. ligustrina* DC. (see this work, Part XL), apparently bears the same relation to *E. eugenioides* Sieb. that *E. Camfieldi* does to *E. capitellata*.

DESCRIPTION.

CCLVII. E. Blaxlandi Maiden and Cambage.

In *Proc. Roy. N.S.W.*, LII, 495 (1918), recapitulating descriptions at *Proc. Linn. Soc. N.S.W.*, xxx, 193 (1905), and the present work, Part VIII, 216, as the Blue Mountains form of *E. capitellata*.

If the reference in the present work (under "Western Localities,") be turned to, it will be seen that the description need not be repeated at this place.

A specimen (Blackheath, Blue Mountains, N.S.W., J. H. Maiden, January, 1905) in the National Herbarium of New South Wales is constituted the type by the authors.

It is figured at Part VIII. Plate 38, of the present work, figures 3*a*, 3*b*, 3*c*, 5. Those figures of the type lack the mature leaf, which is given at fig. 5, Plate 187, of the present Part.

It is named in honour of Gregory Blaxland, who was leader of the first party to cross the Blue Mountains (1813), where many trees of this species are to be found.

RANGE.

It occurs very extensively in New South Wales, both on the tablelands and in the coastal districts. It is also fairly widely diffused in Victoria, chiefly in Gippsland and along the east and south coast (western district), where it joins South Australian localities, extending into the Mount Lofty Range. It has been looked upon as *E. capitellata*, and it will be some time before it is understood that that species, *sensu strictu*, does not occur in the two southern States.

New South Wales.

Western Localities.—Besides the type locality, Blackheath, and other parts of the Blue Mountains from Woodford to Cox's River (Bowenfels), Jenolan Caves and Mount Wilson (see Part VIII, p. 217), we have—

Mount Currucudgy (Rylstone district (R. T. Baker). Upper Meroo (A. Murphy, timber No. 9.899). Fruits very small to medium sized, and some exsert. (A. Murphy). Localities which extend its range in a slightly north-westerly direction.

The Sydney (Outer Domain) form, referred to under *E. capitellata* at p. 217 and figures 4*a–c*, Plate 38, may be looked upon as a nearly glabrous form of *E. Blaxlandi*; it is not typical.

We can now branch to the south.

Southern New South Wales.—We now travel south and find that there is variation in this species, which seems to be capable of grouping, chiefly obvious in the size of the fruits. Let me briefly discuss some of the specimens in detail :—

Waterfall (J.H.M.). Intermediate leaves coriaceous, glabrous, buds stellate; fruits small, capitate.

Woronora (F. W. Wakefield No. 4). Same as Waterfall. Buds slightly glaucous. Compare Gosford.

Cobbity, banks of Nepean, near Camden (J.H.M.). Bluish cast of young foliage. Buds largish; fruits hemispherical, slightly pedicellate.

" Stringybark, like *E. eugenioides*, 150 yards north of hotel; Yerranderie (R. H. Cambage, No. 2,197). Juvenile leaves (upper part of trunk) lanceolate, glabrous; buds brown, stellate; fruits medium-sized fully ripe and valves well exsert. (Like Clyde Mountain, Baeuerlen).

" Blue-leaf Stringybark," Hill Top (J.H.M.). Juvenile leaves like those of Nelligen. The juvenile leaves precisely match those from Mt. Spiraby, near Tenterfield (J.H.M.). I had already pointed out (Part VIII, p. 215) that they also precisely match those of what may be termed the Blue Mountains form of *E. capitellata* (*infra*. p. 216) (This is now *E. Blaxlandi*, of course.) The fruits and juvenile foliage are figured at 6*a* and 6*b*, Plate 38, and a note on them will be found at p. 215 of Part VIII. The fruits are in spherical clusters, and I suggested that this form might be intermediate between *E. capitellata* and *E. eugenioides*, which, although a view I do not hold now, is one that had some acceptance at the time.

Hill Top, buds brown, stellate; also summit of Mount Jellore (both E. Cheel). Buds and fruits like Wombeyan Caves.

1. Berrima (J.H.M. and J. L. Boorman, September, 1901). Intermediate leaves like Clyde Mountain, Baeuerlen. Buds brown, stellate. Fruits varying in size and rim a little.

2. Berrima, on the Mittagong road (D. W. C. Shiress, 1919, 1920). Suckers or intermediate leaves lanceolate to ovate and nearly orbicular, glabrous; buds rounded, stellate; fruits small to smallish, capitate.

No. 1 specimens were noted at p. 216, Part VIII, and figures 7*a* and 7*b* of Plate 38. Chiefly on consideration of the fruits, they were looked upon as a small fruited form of *E. capitellata*, or at all events, intermediate between that species and *E. eugenioides*.

Bowral to Bullio; also Wombeyan Caves, Taralga road (R. H. Cambage, J.H.M.). Juvenile leaves broad, undulate, hairy, precisely like Nelligen. More advanced juvenile leaves are scabrous, broadly ovate, cordate, precisely like those of the New England tableland and those in the neighbourhood of the New South Wales-Queensland border. Buds yellowish to brownish, rounded to pointed like " tip-cats "; fruits with valves exsert and medium in size.

Goulburn (S. Lumsden, No. 15). Fruits small, capitate. Near Goulburn (J. B. Cleland). Fruits a little larger than the preceding (fig. 7*b*, Plate 38), and fewer in the head. Clyde Mountain, Nelligen (W. Baeuerlen, No. 31.)

"Blue-top Stringybark." High elevation at Nethercote, 5 miles west of Eden, on ironstone gravel and trap-rock. (Forester H. H. Rose, No. 16.)

Northern New South Wales.—Let us return to the Sydney district and branch to the north.

Stunted form, about 7 feet in height, diameter of 3 inches, growing on poor sandstone tops, Popran Trig. Reserve 1,158 (W. A. W. de Beuzeville, No. 4). Buds stellate, rounded to slightly angular; fruit capitate.

"Stringybark," Yarramalong, Forest Reserve, No. 38,429, Ph. Wyong (W. A. W. de Beuzeville, No. 25). Blue tint to young foliage, which is glabrous; buds stellate; fruits capitate. "Appears like 25, but general appearance of tree is like a Blackbutt," Yarramalong (W. A. W. de Beuzeville, No. 27). Juvenile foliage broadly ovate to broadly lanceolate, glabrous. Very like New South Wales-Queensland border specimens.

"Stringybark." At an elevation of between 800 and 900 feet near Booral. Attains a size up to 14 or 15 feet in circumference. Buds stellate; fruits smallish, valves exsert. These specimens are figured at figures 9*a* and 9*b*, Plate 38, and there is a note at p. 214 of Part VIII. While there placing them as a small fruited form of *capitellata*, I point out that some botanists may look upon them as a form of *E. eugenioides* with very exsert valves.

Fruits hemispherical, slightly depressed, valves slightly exsert, rim broadish. Murrurundi (J.H.M. and J. L. Boorman). Figured at figs. 22*a*, *b*, Plate 40, as a form of *E. eugenioides*.

A New England Stringybark.—As we go further north, *e.g.*, to New England, New South Wales, there seems to be a break in the Stringybark series, which may, of course, arise from imperfect collecting, and we find that *E. eugenioides*, *E. Blaxlandi*, and *E. Muelleriana* approach in a number of ways, the first being preponderant as at present defined. This New England form I referred to under (*e*) in *Journ. Roy. Soc. N.S.W.*, lii, 495 (1918), as follows:—

(*e*) We have also a form from New England, chiefly, so far as collected, at Wilson's Downfall, Macpherson Range, Wallangarra, Armidale, &c. Also a large tree, which has broad-lanceolate up to orbicular juvenile foliage (I have not seen any coriaceous), with buds as depicted on Plate 37. The fruits are smaller than those of the type (*i.e.*, are of the size of those of 1*b*, 4*c*, 8*c*, Plate 38); sessile to pedicellate. The pedicellate fruits are mostly flat-topped, and with a smooth, distinct rim. The shape of these rimmed fruits may be seen in 1*f*, Plate 38, but in that case the fruits are sessile, the series depicted under fig. 1, however, shows an amount of variation in a South Australian form which is repeated in the New England, New South Wales, specimens now under review.

There is some usefulness in referring to this series in geographical order, going north. Frankly, I cannot separate these trees in some cases by marked characters, and I take the opportunity of contemplating them from the point of view of affinity to *E. Blaxlandi*. At the same time, other botanists will find it useful to consider them

as variants of other Stringybarks. We require further observations (although much collecting has been already done) for they furnish additional evidence of the truth of the Preliminary Note attached to Part VIII. There can be no harm in making a pause.

Juvenile leaves on the whole narrowish, but not representative, some leading to broadish; undulate; buds rounded, stellate. Yarrowitch (J.H.M.). " Tall trees; the principal timber of the district. Juvenile foliage on the narrow side. Buds rather large, bursting into flower, opercula conoid." Yarrowitch (J. L. Boorman).

Buds stellate, or nearly so, brownish; fruits small, capitate, Tia, *via* Walcha (J.H.M.). Figured at 18*a–d*, Plate 40, as *E. eugenioides*. (See also p. 238, Part VIII), with broad sucker leaves, but evidently a form of the present series. Tia River (E. Betche). Very like the preceding, except valves a little more exsert. Walcha (J. F. Campbell). Buds brownish; fruits smallish, hemispherical, slightly exsert.

Then we come to three specimens, A., B., C., collected by the late Dr. A. W. Howitt from the Armidale district :—

A. Armidale district.

B. Between Chandler and Styx Rivers. Bark stringy to smaller limbs and branches. Up to 50 feet.

C. Styx River. A Stringybark tree, tall, 60–70 feet.

Some of A. W. Howitt's Armidale specimens are figured under *E. eugenioides* at figs. 1*a–d*, Plate 39, and they are identical with J. L. Boorman's Stanthorpe (Q.) specimens figured at 2*a–d* of the same Plate. The Armidale specimens are referred to as intermediate between *E. Muelleriana* and *E. eugenioides* at p. 219 of Part VIII. I have other specimens broader than the juvenile leaves figured. They are alike, and belong to the northern Stringybark. Nor can anyone contemplating them doubt their relations to (*e.g.*), the Osler's Creek, Victoria, tree figured at 2*a–c*, Plate 38, nor the Mount Lofty (S.A.) specimens figured at 1*b–f* of Plate 38, both now placed by me under *E. Blaxlandi*. The seedling or sucker leaves are narrow to broadish, some are nearly glabrous, slightly hairy and undulate, the buds stellate, the fruits sessile to pedicellate, nearly hemispherical, but variable.

Another specimen, Armidale (J.H.M.), the common Stringybark of the district, and figured at figs. 1 and 2 of Plate 39, would well stand for it.

State Forest No. 322, Ph. Mackenzie, Co. Hardinge, Armidale district (Forestry Commission, 1918). Same as preceding, with fruits becoming a little more pilular.

Then we have round, plump buds, getting pedicellate, fruits pear-shaped to hemisperical, *e.g.*, Rampsbeck, 30 miles north-east of Armidale (J. F. Campbell). This is another specimen entered as *E. Muelleriana*, but showing transit to *E. eugenioides*.

Then we come to Lawrence, Clarence River (J. V. de Coque). Figured under 21*a*, *b*, Plate 40, as *E. eugenioides*.

Drake (E. C. Andrews). Fruits with well exserted valves. Figured at fig. 19, Plate 40, as *E. eugenioides*, and considered to show transit to *E. Muelleriana*. Drake (A. Hagman), with sunk valves, apparently not as fully developed as the preceding. Figured at fig. 20 as *E. eugenioides*.

See also the Moonambah, Richmond River (W. Baeuerlen), specimens referred to at p. 238 of Part VIII, but not figured, and foot of Mount Lindsay (W. Forsyth) figured at fig. 16*a*, *b*, of Plate 40.

"Woolly Butt." Juvenile leaves broadish, more or less scabrous, and even undulate to glabrous and lanceolate. (An odd leaf as broad as any of Wilson's Downfall; see below). Buds brown, rounded, stellate. Fruits pedicellate, but with pedicels not long; medium in size, hemispherical, rimmed, valves non-exsert to more or less exsert. Bolivia, near Tenterfield (J.H.M.). A similar specimen was referred to as follows in Part VIII, p. 238 :—

"Tenterfield to Sandy Flat (J.H.M.). Fruits very similar to those of *E. eugenioides*, Sydney, *e.g.*, Concord Park (believed to be typical), hemispherical, and somewhat exserted valves. Buds very compressed, almost like *capitellata*. I figured this (Plate 4, Part I) as *E. Muelleriana*, and I now put it under *E. eugenioides* with doubt. It certainly is a transit form.

Juvenile foliage (suckers) lanceolate, glabrous, ; small stellate brown buds; fruits hemispherical, slightly pedicellate, more or less. Some a little *piperita*- or *acmenioides* like, but very variable. Acacia Creek, Macpherson Range (Forest Guard W. Dunn.) At one time looked upon as a small-fruited from of *E. Muelleriana*.

Suckers glabrous, lanceolate. Buds stellate. Fruits very shortly pedicellate, for the most part sessile. Medium sized, rimmed with more or less exsert valves. Cataract Run, near Tenterfield (L. C. Irby). Certainly a transit form between the pedicellate (*eugenioides*) series and the sessile (*Blaxlandi*).

Tree of 20 or 30 feet. Suckers not in the youngest state nearly glabrous (shining upper surface). Buds clavate, nearly bursting into flower. Fruits somewhat *E. pilularis*-like, becoming exsert. Pedicels very short or none. Wallangarra (J. L. Boorman). This is another intermediate form related to *E. eugenioides* and perhaps *E. Muelleriana*.

Then we have, suckers broad, nearly orbicular to broadly lanceolate, glabrous; buds small, brown, stellate to clavate, with pointed opercula when bursting into flower (it is very desirable to describe the shape of the buds when they are bursting into flower if possible, as they have a definite shape for that form); fruits smallish to medium large, exsert to prominently exsert. Pedicellate to sessile. Wilson's Downfall (R. H. Cambage, Nos. 2,822, 2,826, 2,839). This is another puzzling form, named at different times *E. eugenioides* and *E. capitellata*, though not typical.

QUEENSLAND.

Buds slightly pedicellate, slightly glaucous; fruits medium, *E. pilularis*-like. Stanthorpe (J. L. Boorman). Figured at 2*a–d*, Plate 39, and not distinguishable from the Armidale specimens already referred to.

Now let us turn to Victoria and South Australia, beginning with Victoria.

VICTORIA.

It seems to me that the true *E. capitellata* does not extend to Victoria, and that Mr. Howitt's notes on Gippsland forms, quoted at Part VIII, p. 217, refer to

E. Blaxlandi. One of Mr. Howitt's specimens was figured at 2*a–c*, Plate 38, as regards seedling leaves, buds, and fruits. They are from Osler's Creek, and have much in common with *E. Blaxlandi* from the Blue Mountains and the South Coast of New South Wales. The seedling leaves are narrower than those depicted for the type, but many of the type specimens are similar. The chief difference is that the fruits are more pedicellate than those of the type.

"Small fruited Yellow Stringybark," but when freshly cut and green the heart wood is brown in colour. Wangarabelle, also found plentifully between Genoa and Mallacoota, and at Cann River; also at Orbost. (H. Hopkins, 1915).

Now let us proceed to Western Victoria (Portland district). If we turn to page 213, Part VIII, with the corresponding figures 8, 9, 10 of Plate 37, we find that they have a good deal in common with *E. Blaxlandi*, and are perhaps inseparable from that species; they also possess affinity to *E. capitellata*, from which they differ in the following points:—In the broader suckers, which are nearer those of *E. capitellata*, and in the pedicellate fruits with the valves less exsert.

At the same time the affinities to *E. lavopinea* R. T. Baker are worthy of consideration, and should be worked out. (This form of *E. Blaxlandi* ascends to the Grampians, see p. 218, Part VIII, and fig. 12 of Plate 37).

South Australia.

These Western Victorian specimens carry us on to South Australia, and the species is found in the south-east, Kangaroo Island, Mount Lofty, and elsewhere.

A reference to the south-east is under Narracoorte, p. 218, Part VIII, where we have clavate, scarcely angular buds, with domed fruits, valves well exsert. These are figured at 11, Plate 37.

There is a reference to a Kangaroo Island specimen collected by Robert Brown about 1802 at p. 213 of Part VIII, viz.:—

Kangaroo Island, Hundred of Cassini (W. J. Spafford, No. 7, 1916). This cannot be separated from figs. 11*a* and 11*b*, Plate 37 (Narracoorte).

We now come to the Mount Lofty specimens referred to at p. 218, Part VIII, and if we turn to figures 1*b–f* of Plate 38 of fruits *all gathered from the same tree*, we have a remarkable instance of variation in this species. Fruits sessile, shortly pedicellate, rim flat-topped or domed, valves sunk or exsert. Some of the specimens are remarkably like the type of *E. Blaxlandi*.

Then we have Aldgate, near Mount Lofty (J.H.M.), with juvenile leaves scabrous, nearly orbicular to oblong and broadly lanceolate. Not to be separated from the Narracoorte specimens (S.A.), nor from those from Osler's Creek (Vic.). See also Willunga, Mount Lofty Range (W. Gill).

The following locality is more distant. One or two miles west of Bordertown, where the scrub of the 90-mile Desert begins (J. M. Black, No. 2). Like Narracoorte, but with mostly smaller fruits.

DESCRIPTION.

CCLVIII. E. Normantonensis Maiden and Cambage.

In *Journ. Roy. Soc. N.S.W.*, lii, 490 (1918.)

" Box "-arbores parvae altae pedes decem ad triginta, interdum aliquem de " Mallee " admonentes. " Box "-cortex in arboris trunco et ramis magnis. Rami superiores interdum leves et subvirides. Arbores localiter ut " Box " cognitae.

FOLIA JUVENILIA.—In conditione immaturissimâ non visa, sed sub-glauca sunt, ramusculi angulares, folia lanceolata, exique petiolata, longa circiter novem cm. (tres uncias et dimidium) et 2–2·5 cm. lata, irregulariter pinnata, venae secundariæ apud angulum 45° e mediâ costâ; vena intramarginata clare a margine denota.

FOLIA MATURA.—Lucide viridia, aliquanto nitida, contusa nullum oleiodorem dant. Angusta-lanceolata, pyramidata speciatim in apice, directa vel aliquanto falcata, petiolata, ad decem cm. (quatuor uncias) et longiora, et plerumque infra unum cm. lata, viridia cum flavedine, utrobique color idem, cum multis inconspicuis fere pinnatis venis secundariis.

FLORES.—Pedunculi aliquanto breves terminales in exemplis conducibilibus, in singulis umbellis circiter quinque ad septem flores aliquanto parvi. Gemmae obtuse clavatae, calycistubus gradatim pyramidatus in pediculum. Gemmae saepe alterius vel externi operculi vertigium gerunt. Operculum hemisphaerium cum mucrone brevissimo, in longum circiter supremi calycis tubi trientem. Antheræ ut in *E. gracilis*.

FRUCTUS.—Fructus parvus, cylindraceus-urceolatus, circiter quatuor mm. longus et tres mm. latus. Ora angusta ab annulo stamines constante coronata, capsula profunde suppressa.

TYPUS.—R. H. Cambage, No. 3,930 (fructifer).

Pauca millia passuum ad orientem et meridiem e " Normanton " (sinus " Carpentaria " civitas " Queensland ") in formationem arenaceam et cretaceam calculos ferreos continentem.

Etiam in viam a " Normanton " ad " Cloncurry " inter rivos " Normanton " et " Flinders " occurrit.

Small Box-trees of 10 to 30 feet, sometimes suggestive of Mallee. Box-bark on trunk and large branches. Upper branches sometimes smooth and greenish. Known locally as " Box."

JUVENILE LEAVES.—Not seen in the earliest state, but are sub-glaucous, branchlets angular, leaves lanceolate, shortly petiolate, up to say 9 cm. (3½ inches) long, and 2–2·5 cm broad, irregularly pinnate, the secondary veins at about an angle of 45 degrees with the midrib; intramarginal vein distinctly removed from the edge.

MATURE LEAVES.—Bright green, somewhat shiny, give no odour of oil when crushed. Narrow-lanceolate, tapering, particularly to the apex, straight or somewhat falcate, petiolate, up to 10 cm. (4 inches) and more, and usually under 1 cm. wide, yellowish green, the same colour on both sides, with numerous not conspicuous almost pinnate secondary veins.

FLOWERS.—Peduncles shortish, terminal in the specimens available, each umbel with about five to seven rather small flowers. Buds bluntly clavate, the calyx-tube gradually tapering into the pedicel. The buds often carry the remains of a second or outer operculum. The operculum hemispherical, with a very short mucro, about a third as long as the ridge calyx-tube. Anthers as in *E. gracilis*.

FRUITS.—Fruit small, cylindroid-urceolate, about 4 mm. long and 3 mm. broad. The narrow rim crowned by a persistent staminal ring, the capsule deeply sunk.

Type. R. H. Cambage, No. 3,930 (in fruit).

RANGE.

A few miles to the east and south of Normanton (Gulf of Carpentaria, Queensland), on a sandy cretaceous formation containing ironstone pebbles. Also occurs on Normanton–Cloncurry road between Normanton and Flinders River (R. H. Cambage).

Normanton (Ivie Murchie).

The description was drawn up from Mr. Cambage's No. 3,930, with the exception of that of the ripe bud and stamens, in which Mr. Murchie's specimen has been used.

The trees provisionally identified as *Eucalyptus gracilis* (No. 3,930) are growing a few miles to the east and south of Normanton on a sandy cretaceous formation containing ironstone pebbles. They are small box trees from 10 to 30 feet high, often with branching stems suggestive of Mallee, leaves bright green and shiny, yielding no smell of oil when crushed, box bark on trunk and large branches, some small branches smooth and greenish, adult leaves from 3 to 4½ inches long, about 1 cm. wide, juvenile leaves up to 3 inches long and 1¼ inches wide, fruits about 4 mm. long and 3 mm. in diameter. Leichhardt appears to have passed through this identical forest after crossing the Norman River, the native name of which he gives as the "Yappar." He writes:—"The hills were composed of iron-sandstone . . . . . The intervening flats bore either a box-tree with a short trunk branching off immediately above the ground," &c. (R. H. Cambage, in *Journ. Roy. Soc. N.S.W.*, xlix, 422-3, 1915.)

I have received the species from Berricannia, between Muttaburra and Hughenden. Trees quite common about the homestead. (Mr. Svensson, through C. T. White.)

Dr. H. I. Jensen says that a medium sized gum answering to the description of *E. Normantonensis* is very common on desert sandstone country, associated with Lancewood (Acacia *Shirleyi* ?) and Yellow Jacket (*E. peltata*).

AFFINITY.

With *E. gracilis* F.v.M.

It is closely allied to this species, but the leaves are of a different texture, and there is a sticky exudation in patches, the result of insect punctures. The juvenile leaves are broader and have a different venation to that of *E. gracilis*. There are no conspicuous oil-dots on the buds, as in the case of *E. gracilis*. The fruits, although very similar in shape to those of *E. gracilis*, are crowned by the persistent staminal rings as in some of the Ironbarks and Boxes.

J. E. Tenison-Woods (*Proc. Linn. Soc. N.S.W.*, vii, 337) speaks of *E. gracilis* in Queensland, but we now know that most of the specimens to which he refers belong to *E. Thozetiana* F.v.M. Local observers might, however, inquire if those trees seen by him "on the dry sandy scrubs on the Burdekin River, not far from Charters Towers," refer to that or the present species.

This species had already been referred to twice in the *Journ. Roy. Soc. N.S.W.*, viz., xlix, 326–7, in which I looked upon it as an aberrant form of *E. calycogona* var. *gracilis*. The second occasion is in xlix, 422, by Mr. R. H. Cambage, who collected the material both he and I provisionally described. He points out that it is probably referred to by Leichhardt, " Overland Expedition to Port Essington," p. 337, in words he quotes. It seemed to us that it is worthy of specific description. The first passage referred to is as follows :—

" I now desire to invite attention to a form first received from Mr. Ivie Murchie from Normanton, Queensland, not far from the Gulf of Carpentaria, in November, 1911, under the name of ' Box Wood.'

Enquiries failed to elicit any further particulars until Mr. R. H. Cambage collected it at the same place in August, 1913. He obtained a full suite of specimens, and furnished the following particulars:—' No. 3,930. Small Box-trees of 10 to 30 feet, sometimes suggestive of Mallee. Leaves bright green, somewhat shiny, give *no* odour of oil when crushed. Box-bark on trunk and large branches. Upper branches sometimes smooth and greenish.

Formation pebbly (ironstone) and sandy; cretaceous (?).

Also occurs on Normanton–Cloncurry road between Normanton and Flinders River.'

So far as I am aware, var. *gracilis* has not been recorded previously from nearer than 1,500 miles, and it is not surprising that the Normanton specimens differ a little from the type. I fail to get hold of any characters of sufficient importance to separate it from var. *gracilis*, and therefore note *E. calycogona* var. *gracilis* as an addition to the Queensland flora.

Compared with typical var. *gracilis*, the leaves are of a different texture, and there is a sticky exudation in patches, the results of insect punctures.

Mr. Cambage's note of absence of oil does not mean that there is no oil at all, for the oil dots can be seen and are not scarce, but in comparison with other forms there is an absence of oil. At the same time the leaves from southern specimens of var. *gracilis* vary a good deal in oil content. The most important character is that the inflorescence is terminal in the Normanton specimens (chiefly those of Mr. Murchie), whereas it seems to be usually axillary in all our other specimens."

EXPLANATION OF PLATES (184-187).

PLATE 184.

E. erythrocorys F.v.M.

1*a*. Juvenile leaf; 1*b*, mature leaf, of No. 70, 6th Collection, Western Australia (James Drummond).

2*a*. Juvenile leaf, covered on both sides with stellate hairs; 2*b*, mature leaf; 2*c*, the axis; 2*d*, a sessile bud and a newly expanded flower on a long, flattened peduncle; 2*e*, stamens; 2*f*, the biretta-like operculum looked at from above; 2*g*, an individual flower, looked at from above, showing the stamens (somewhat tufted, and a little diagrammic) and the stigma. All from specimens grown in the Botanic Gardens, Sydney, from seed from near Dongarra, W.A., (Mr. E. W. Clarkson, through Mr. W. D. Campbell, L.S.).

3*a*, 3*b*. Different views of fruits from the Murchison River, W.A. (Augustus Oldfield, in the Vienna Herbarium).

4. Fruit from near Dongarra, the largest I have seen (W. D. Campbell).

PLATE 185.

E. tetrodonta F.v.M.

1*a*. Juvenile leaf; 1*b*, intermediate leaf. Darwin, Northern Territory (Dr. H. I. Jensen, July, 1916).

2. Buds with strongly marked wing-like processes to the operculum. Messmate Creek, Packhorse Range, North-West Australia (W. V. Fitzgerald, No. 1,214).

3*a*. Buds; 3*b*, a flower in elevation; 3*c*, a flower in plan; 3*d*, front and back view of anthers; 3*e*, mature leaf and fruits; 3*f*, plan of a fruit. Pine and Horseshoe Creeks, Northern Territory (E. J. Dunn).

PLATE 186.

E. odontocarpa F.v.M.

1*a*. Twig with young buds; 1*b*, the same enlarged; 1*c*, twig with fruits. Sturt's Creek, Northern Territory (Mueller). From a drawing of the type at Kew, made by Miss M. Smith.

2. Broad, young leaf, as young as I have seen it. Desert south of Fitzroy River, West Kimberleys, North-West Australia (W. V. Fitzgerald, September, 1906).

3*a*. Front and back views of anthers; 3*b*, twig with fruits in various stages of maturity. Tanami Gold-field, Northern Territory (Dr. H. I. Jensen, through C. E. F. Allen).

NOTE.—Tanami is a gold-field, and not a tin-field, as inadvertently so recorded in this work in Part XXXVII, p. 186 (under *E. aspera*) and Part XXXVIII, p. 212 (under *E. setosa*).

E. capitellata Sm.

4*a*. Orbicular juvenile leaf in the earliest stage; 4*b*, juvenile leaf a little further advanced; 4*b*, juvenile leaf still further advanced, with the venation modified; 4*d*, mature leaf. Corner of the Pittwater and Spit roads, Port Jackson (W. F. Blakely and D. W. C. Shiress).

This species is also figured in Part VIII, Plate 37, figures 1, 2, 3, 5, 6, 7.

PLATE 187.

E. Camfieldi Maiden.

1*a*. Juvenile leaves in the orbicular state; 1*b*, juvenile leaves, a stage more advanced, becoming pointed at the apex; 1*c*, a juvenile leaf of a larger size, entirely covered with stellate hairs, but more thickly at the back; a portion of the leaf is enlarged to show the thick marginal vein and the stellate hairs; 1*d*, mature leaf, thick and very shiny; 1*e*, umbel of buds, nine in the head; 1*f*, front and back view of anther; 1*g*, fruits. West side of Berowra Creek, Hornsby, near Sydney (W. F. Blakely).

2. Intermediate leaf, on a twig bearing juvenile leaves. About half a mile south from the 17-mile post, Galston road, Hornsby (W. F. Blakely).

3*a*. Twig with fruits having exserted valves; 3*b*, immature fruits. Woronora River, Heathcote, a little south of Botany Bay (J. L. Boorman and J.H.M.).

4*a*. Front and back views of anthers; 4*b*, fruits so compressed as to be almost syncarpous. Waterfall, a few miles south of Sydney (R. H. Cambage, No. 4,169).

The juvenile leaves figured at fig. 4, Plate 37, belong to this species.

E. Blaxlandi Maiden and Cambage.

5. A mature leaf, Blackheath, N.S.W. (J.H.M.). From the type, which is further figured as regards juvenile leaves, buds and fruits at Plate 38, figs. 3*a*-3*c*.

E. Normantonensis Maiden and Cambage.

6*a*. Intermediate leaf; 6*b*, buds; 6*c*, front and back views of anthers. Normanton, Queensland. (Ivie Murchie).

7*a*. Juvenile leaf, as young as I have seen one; 7*b*, mature leaf; 7*c*, fruits; 7*d*, plan of the fruit. Normanton (R. H. Cambage, No. 3930). *The type.*

The following species of Eucalyptus are illustrated in my "Forest Flora of New South Wales"* with larger twigs than is possible in the present work; photographs of the trees are also introduced wherever possible. Details in regard to their economic value, &c., are given at length in that work, which is a popular one. The number of the Part of the Forest Flora is given in brackets :—

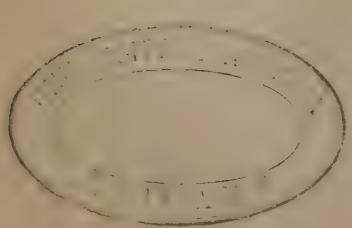
acacioides A. Cunn. (xlviii).
acmenioides Schauer (xxxii).
affinis Deane and Maiden (lvi).
amygdalina Labill. (xvi).
Andrewsi Maiden (xxi).
Baileyana F.v.M. (xxxv).
Baueriana Schauer (lvii).
Baueriana Schauer var. *conica* Maiden (lviii).
Behriana F.v.M. (xlvi).
bicolor A. Cunn. (xliv).
Boormani Deane and Maiden (xlv).
Bosistoana F.v.M. (xliii).
Caleyi Maiden (lv).
capitellata Sm. (xxviii).
conica Deane and Maiden (lviii).
Consideniana Maiden (xxxvi).
coriacea A. Cunn. (xv).
corymbosa Sm. (xii).
crebra F.v.M. (liii).
Dalrympleana Maiden (lxiv).
dives Schauer (xix).
dumosa A. Cunn. (lxv).
eugenioides Sieber. (xxix).
fruticetorum F.v.M. (xlii).
gigantea Hook. f. (li).
globulus L'Her. (lxvii).
goniocalyx F.v.M. (vi).
hæmastoma Sm. (xxxvii).
hemiphloia F.v.M. (vi).
longifolia Link and Otto (ii).
Luehmanniana F.v.M. (xxvi).
macrorrhyncha F.v.M. (xxvii).
maculata Hook. (vii).
melanophloia F.v.M. (liv).
melliodora A. Cunn. (ix).
microcorys F.v.M. (xxxviii).
microtheca F.v.M. (lii).
Muelleriana Howitt (xxx).
numerosa Maiden (xvii).
obliqua L'Hérit. (xxii).
ochrophloia F.v.M. (l).
odorata Behr. and Schlectendal (xli).
oleosa F.v.M. (lx).
paniculata Sm. (viii).
pilularis Sm. (xxxi).
piperita Sm. (xxxiii).
Planchoniana F.v.M. (xxiv).
polyanthemos Schauer (lix).
populifolia Hook. (xlvii).
propinqua Deane and Maiden (lxi).
punctata DC. (x).
radiata Sieb., as *amygdalina* (xvi).
regnans F.v.M. (xviii).
resinifera Sm. (iii).
rostrata Schlecht. (lxii).
rubida Deane and Maiden (xliii).
saligna Sm. (iv).
siderophloia Benth. (xxxix).
sideroxylon A. Cunn. (xiii).
Sieberiana F.v.M. (xxxiv).
stellulata Sieb. (xiv).
tereticornis Sm. (xi).
tessellaris F.v.M. (lxvi).
Thozetiana F.v.M. (xlix).
viminalis Labill. (lxiv).
virgata Sieb. (xxv).
vitrea R. T. Baker (xxiii).

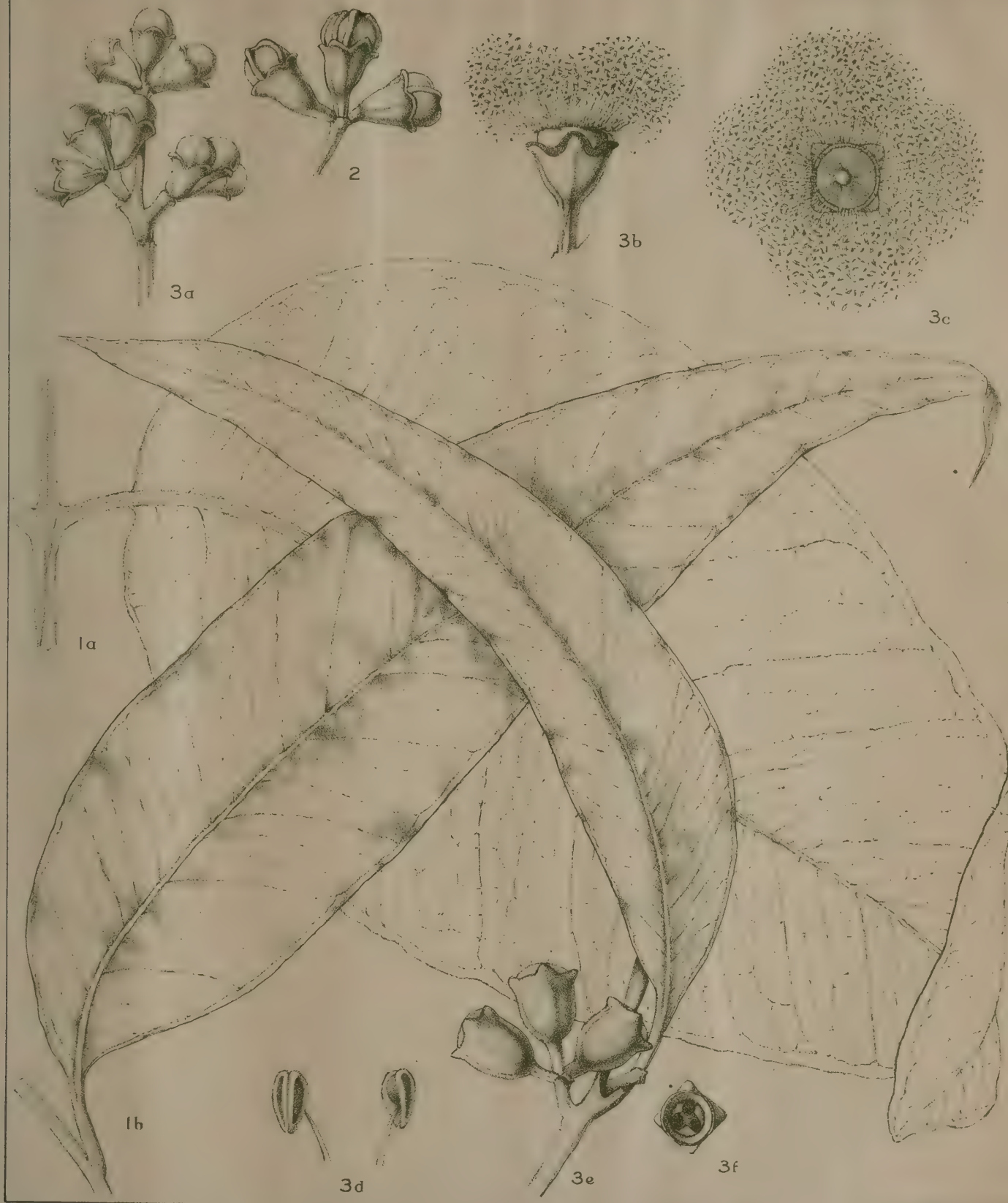
* Government Printer, Sydney. 4to. Price 1s. per part (10s. per 12 parts); each part containing 4 plates and other illustrations.

Sydney: William Applegate Gullick, Government Printer—1923.

M. Flockton del. et lith.

EUCALYPTUS ERYTHROCORYS F.v.M.





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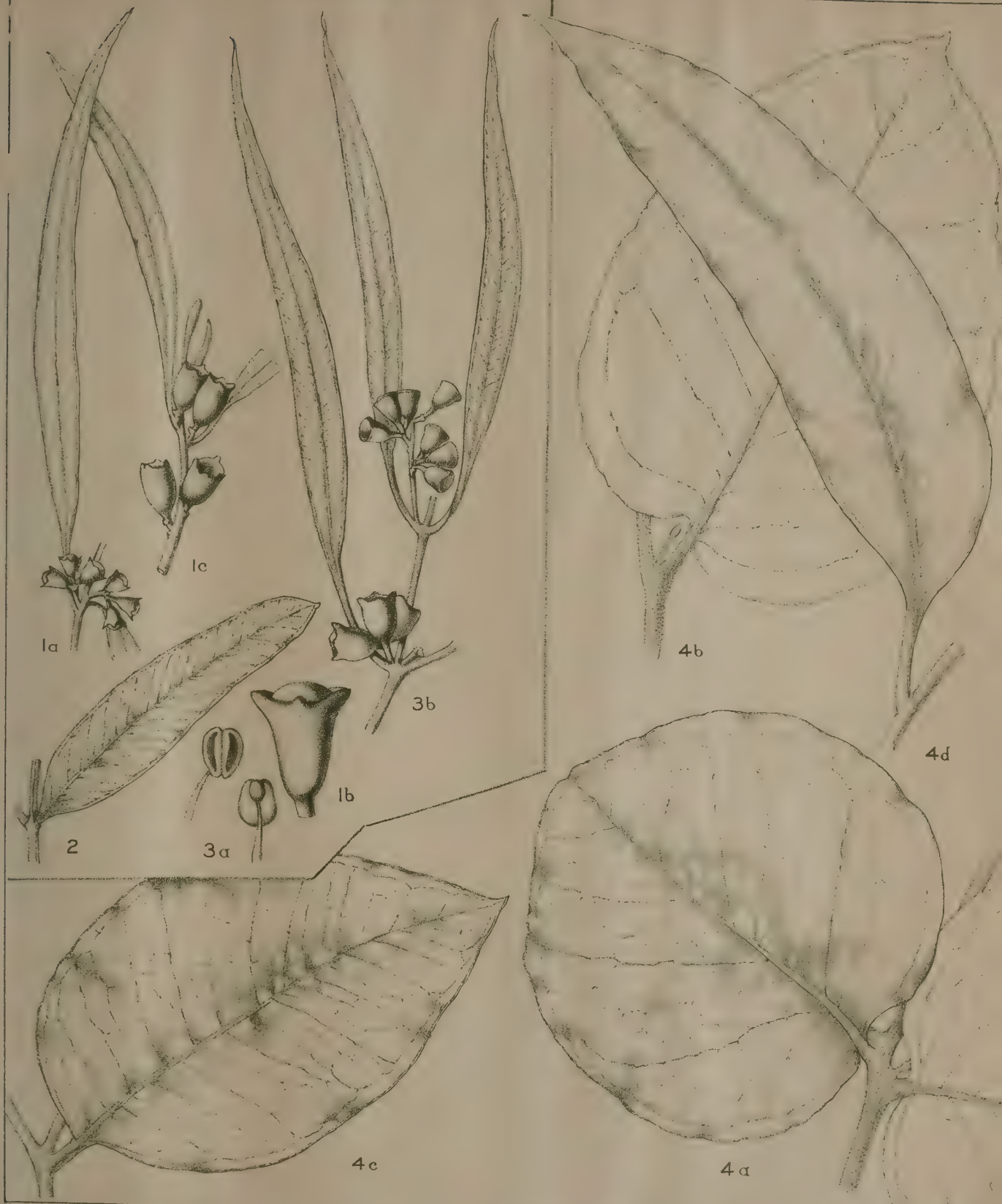
EUCALYPTUS TETRODONTA F.v.M.



M Flockton del. et lith.

EUCALYPTUS ODONTOCARPA F.v.M. (*1–3*)
EUCALYPTUS CAPITELLATA Sm. (*4*) [See also Plate 37, Figs. 1, 2, 3, 5, 6.]

EUCALYPTUS CAMFIELDI MAIDEN (*1–4*) [See also Fig. 4, Plate 37.]
EUCALYPTUS BLAXLANDI MAIDEN and CAMBAGE (*5*) [See also Fig 3, Plate 38.]
EUCALYPTUS NORMANTONENSIS MAIDEN and CAMBAGE. (*6, 7*)

A Critical Revision of the genus Eucalyptus

BY

J. H. MAIDEN, I.S.O., F.R.S., F.L.S.

(Government Botanist of New South Wales and Director of the Botanic Gardens, Sydney).

Vol. V. Part 6.

Part XLVI of the Complete Work.

(WITH FOUR PLATES.)

"Ages are spent in collecting materials, ages more in separating and combining them. Even when a system has been formed, there is still something to add, to alter, or to reject. Every generation enjoys the use of a vast hoard bequeathed to it by antiquity, and transmits that hoard, augmented by fresh acquisitions, to future ages. In these pursuits, therefore, the first speculators lie under great disadvantages, and even when they fail, are entitled to praise."

MACAULAY'S "ESSAY ON MILTON."

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DESCRIPTION.

CCLIX. E. tetragona F.v.M.

In *Fragm.* iv, 51 (1864).

Following is a translation of the original :—

A shrub, tree-like, branchlets somewhat winged, or acutely tetragonal, *leaves* opposite or sub-opposite, coriaceous, lanceolate or ovate-lanceolate or ovate, more rarely orbicular, with rather long and compressed petioles, prominently penniveined, reticulately veined, peripheral vein more or less removed from the margin, *peduncles* axillary, solitary, compressed, about 3-flowered, rarely absent, pedicels acute angled, shorter than the calyx-tube, which is truncate-ovate, quadridenticulate, several times longer than the depressed hemispherical, cruciate, quadristriate *operculum*, *stamens* in four bundles, a little distant from each other or together, *fruits* rather large, truncate-ovate, or more rarely somewhat globose, 2 to 4 ribbed, 4 or more rarely 5-celled, the smooth rim of the capsule included, the *fertile seeds* rather large, narrowly winged, near the acute angles.

In the hilly coastal tracts from the Stirling Range to Cape Arid (Western Australia).

A shrub soon growing taller or increasing in season to a rather small tree, with a trunk then of 25 feet; in its young state it is like *E. globulus*, especially in its branchlets, petioles, and chalky white inflorescence. The petioles, with narrowed curved back wings, are decurrent and as it were 2-keeled. Leaves mostly 2–4 inches long, ¾–2 inches broad, more often acute than obtuse, margin slightly thickened, the younger ones glaucous on both sides, the older ones greener, always opaque, more or less covered with pellucid dots or almost imperforate. Peduncles an inch long or shorter, sometimes cuneate-dilated. Pedicels 1–6 lines long. Bracts almost cymbiform, in the apex of the peduncle, a few lines long, deciduous. Buds campanulate-obovate. Operculum about 3 lines broad and 1 line deep, always in four divisions. Filaments free, although in bundles crowded together alternately with the ribs of the calyx-tube, very numerous, whitish, becoming tawny yellow (fulvescentia), the longer ones measuring 3–4 lines. Anthers small, ovate-cordate. Fruits measuring ½–¾ inch, somewhat contracted at the orifice.

E. odontocarpa, E. tetradonta, and E. eudesmioides have a similar quadridentate calyx in which the stamens are collected more or less distinctly into bundles, but on account of this one point it is not possible to separate *Eudesmia* from the genus *Eucalyptus*.

It was then described by Bentham (B.Fl. iii, 259) in the following words :—

Varying from a low scrubby shrub, densely covered with a white meal, to a small tree, of 20 to 25 feet, the specimens often entirely deprived of the whiteness; branches mostly 4-angled or almost 4-winged, rarely terete. *Leaves* mostly opposite or nearly so or the upper ones alternate, from broadly ovate and very obtuse to lanceolate-falcate and almost acute, rarely above 4 inches long, thick and rigid, with diverging but rather distant veins, the intramarginal one at a distance from the edge. *Peduncles* axillary, short, thick, angular or flattened, with three or very rarely four or five rather large flowers, on thick angular or flattened pedicels. Calyx-tube campanulate, about 3 or rarely nearly 4 lines long and broad, with four minutely prominent teeth, sometimes very conspicuous, sometimes scarcely perceptible. *Operculum* depressed-hemispherical, shorter than the calyx-tube, smooth. *Stamens* 3 to 4 lines long, more or less distinctly arranged in four clusters or bundles, alternating with the calyx-tube, but the claws or dilatations of the disk very short or scarcely perceptible; anthers small, with parallel cells opening longitudinally. *Fruit* ovoid or nearly globular, truncate, contracted at the orifice, smooth or more or less ribbed, ½ to ¾ inch diameter, the rim scarcely distinct; *capsule* sunk, usually 4-celled.

Oldfield observes that from the abundance of essential oil this species contains, it is killed down to the ground by the periodical fires, when other plants are only a little scorched, and is thus generally to be found only in an untidy ragged, scrubby form, but he has seen dead stems of 25 feet.

In 1906, Dr. Diels (translation herewith) wrote :—

" Of the species with juvenile characters *E. tetragona* (R.Br.) F.v.M. is one of the most conspicuous, if observed typically. I have frequently observed this shrub in the south-eastern part of the south-west province of Australia, from Stirling Range to Esperance Bay, in sandy heathy country. One gets the best impression of its appearance if one calls to one's mind the juvenile form of *E. globulus*, so common in gardens in *Europe;* the branches are remarkably strongly quadrangular, dusted over with white or bluish-white, the leaves are opposite, thick, ovate-lanceolate to ovate, or rarely orbicular, also strongly glaucous." (L. Diels, *Jugendformen und Blutenreife*, p. 94.)

After travelling amongst a good deal of it, I published the following note in 1911 :—

" The seedlings have the leaves decussate, glandular and glandular-hairy on branches and along margins of leaves, and also on the backs of the midribs. The branches are very square and the whole plant reeks with oil.

The leaves when young always stalked (flattened stalked) and the young foliage is plum-coloured.

It is a shrub, always straggly, sometimes attaining a height of 10 feet. It is known as ' White Marlock,' and is a striking object.

Owing to the dazzling whiteness of the plants, the cream coloured flowers are by no means conspicuous, neither are they large. The colour of the filaments is cream, the anthers are small, and the stamens are in bundles (*Eudesmiæ*).

It is common from Hopetoun to near Ravensthorpe, also common on the Kalgan Plains." (*Journ. W.A. Nat. Hist. Soc.*, Vol. III.)

I also found it at Esperance. It is not always opposite-leaved; it is very frequently alternate.

SYNONYMS.

1. *Eudesmia tetragona* R.Br.

2. *Eucalyptus pleurocarpa* Schauer.

1. *Eudesmia.*

Following is a translation of the Latin original :—Myrtaceæ, between Eucalyptus and Angophora.

Generic characters.—Calyx superior, 4-toothed. Petals firmly connate to the 4-striate deciduous operculum. Stamens in four polyandrous bundles, alternating with the teeth of the calyx, connate at the base. Capsule 4-celled, polyspermous, dehiscing at the apex.

The following is in English :—

Eudesmia tetragona Tab. 3. In exposed barren places, near the shores in the neighbourhood of Lucky Bay on the south coast of New Holland in 34° S. lat. and 123° E. long. Gathered both in flower and fruit in January, 1802.

Then comes a Latin description, of which the following is a translation :—

Shrub of 3 to 5 feet, branches spreading, branchlets tetragonous, with marginate angles. Leaves opposite, at one time sub-opposite, petiolate, more often turned back, lanceolate or oblong, coriaceous, compact, margin entire, glaucous, with resinous dots, veins hardly immersed, anastomosing, 3–4 inches long, 14–16 lines broad. Umbels lateral, few-flowered, peduncles and pedicels two-edged, calyx turbinate, obtusely tetragonous, cohering with the ovary, with the angles at the top drawn out into short, subunequal teeth, the two opposite ones a little larger. Operculum depressed hemispherical, with a point, glandular, whitish, marked with four cruciform striæ, slightly depressed opposite the teeth of the calyx, as if composed of the four petals, deciduous. Stamens very many; filaments in four bundles, approximately opposite the petals, hair-like, glabrous, white, the inner ones decidedly shorter; anthers ovate-subrotund, incumbent, yellowish white, dehiscing with longitudinal cells. Ovary included in the adherent tube of the calyx, four-celled; style 1, cylindrical; stigma obtuse. Capsule included and connate with the enlarged turbinate, oblong, woody calyx-tube, dehiscing in four divisions at the apex.

Obs.—There can be no doubt respecting the affinity of this genus, which belongs to Myrtaceæ and differs from *Eucalyptus* solely in having a striated operculum placed within a distinctly toothed calyx, and in its filaments being collected into bundles. The operculum in *Eudesmia*, from the nature of its striae, and their relation to the teeth of the calyx, appears to be formed of the confluent petals only; whereas, that of *Eucalyptus*, which is neither striated nor placed within a distinct calyx, is more probably composed, in several cases at least, of both floral envelopes united. But in many species of *Eucalyptus* a double operculum has been observed; in these the outer operculum, which generally separates at a much earlier stage, may perhaps be considered as formed of the calyx, and the inner consequently of corolla alone, as in *Eudesmia;* this view of the structure appears at least very probable in contemplating *Eucalyptus globulus*, in which the cicatrix caused by the separation of the outer operculum is particularly obvious, and in which also the inner operculum is of an evidently different form.

Jussieu, in some observations which he has lately made on this subject (in *Annales du Mus.* 19, p. 432) seems inclined to consider the operculum of *Eucalyptus* as formed of two confluent bracteæ, as is certainly the case with respect to the calyptra of *Pileanthus*, and of a nearly related genus of the same natural family. This account of its origin in *Eucalyptus*, however, is hardly consistent with the usual umbellate inflorescence of that genus; the pedicelli of an umbel being always destitute of bracteæ; and in *E. globulus*, where the flowers are solitary, two distinct bracteæ are present as well as a double operculum. But a calyptra analogous to that of *Pileanthus* exists also in most of the species of *Eucalyptus*, where it is formed of the confluent bracteæ common to the whole umbel, and falls off at a very early period. Robert Brown in "Appendix to Flinders' Voyage," ii, 599, t. 3; also his "Miscellaneous Botanical Works" (Ray Soc.), i, 74.

2. *Eucalyptus pleurocarpa* Schauer, in Lehmann's *Plantæ Preissianæ*, i, 132 (1844–5).

The type came from Cape Riche.

RANGE.

It is confined to Western Australia. The type came from coastal hilly tracts from the Stirling Range to Cape Arid, but the original *Eudesmia tetragona* comes from Lucky Bay, which is a little to the east of Esperance.

"From Cape Arid (Maxwell) to Lucky Bay (R. Brown), Cape Riche (Preiss), South West Bay (Oldfield), the vicinity of Stirling's Range (F.v.M.), and thence northward at least as far as the remotest sources of the Swan River (Th. Muir)." ("Eucalyptographia.")

From this the idea must not be taken away that *E. tetragona* occurs in the Swan River District. It occurs in a limited area of the southern district from the Stirling Range district to the Esperance district, Lucky Bay being its furthest record east, although I expect it to be found further east than that.

Following are some specimens in the National Herbarium, Sydney :—

East of Katanning (Dr. F. Stoward); Kalgan Plains (J.H.M.); " Marlock or Spearwood," Stirling Range (Collector for Andrew Murphy). East from Solomon's Well, Stirling Range (Dr. A. Morrison); " From the south-west front of the Stirling Range to east Mount Barren," (Collector of Mueller); Cape Riche (Maxwell).

" Large leaf Eucalypt, scrubby, dwarf, 5–10 feet. Poor sandy ridge, midway between the eastern end of the Stirling Range and Growangerup. Only a small patch of it, but Mr. Rowe says there are miles of it on the way to Ravensthorpe." (W. C. Grasby.)

Hopetoun to Ravensthorpe, plentiful from end to end of the railway which connects the two places (34 miles). It is hardly conceivable that it ends at Ravensthorpe (J.H.M.). Esperance (J.H.M.). Lucky Bay (Robert Brown). The type.

AFFINITIES.

1. With ***E. eudesmioides*** F.v.M. See under *E. eudesmioides* at p. 168.

2. With ***E. incrassata*** Labill., var. ***angulosa.***

Drummond's IV, 75, is, according to Bentham, *E. incrassata* Labill. var. *angulosa* (figured at fig. 1, Plate 14 of the present work), but a specimen of Drummond's No. 75 (1848) from Herb. Oxon., in bud and flower, is *E. tetragona* F.v.M. Other specimens bearing the same number are *E. tetragona.* The explanation is that, under this number, we have mixed material, for the two species are not closely related.

DESCRIPTION.

CCLX. E. eudesmioides F.v.M.

In *Fragm.* ii, 35 (1860).

Following is a translation of the original :—

Dull green, leaves alternate, opposite or sub-opposite, ovate or narrow-lanceolate, acute or acuminate, slightly curved, more seldom sub-falcate, spreading and prominently penniveined, covered with bright dots, *umbels* with not more than three flowers, *peduncles* and *pedicels* shorter than the calyx, rarely of the same length. *Buds* obovate, indistinctly tetragonous, *calyx-tube* ovate-campanulate, two or three times longer than the hemispherical operculum, the tooth of the fascicle of stamens thickened, semiorbicular and pointed; *fruits* ovate-campanulate, scarcely angled, 3–4 celled, the vertex of the capsule smooth, valves inserted near the margin of the fruit, the *fertile seeds* surrounded by a very narrow wing.

In sandy plains and limestone hills near the Murchison River, at least up to Mount Curious, as well as towards the Bay (Shark's) (Walcott and Oldfield).

Shrub 4–12 feet high. Called " Mallalie " by the aborigines. Branches rather smooth, branchlets compressed tetragonous. Leaves for the most part ½–4 inches long, ¼–1 inch broad, with very short and sometimes long petioles, thinly coriaceous, imperforate when old, marginate, pale-green, never hoary, peripheral veins rather distant from the margin. Peduncles at first about 2 lines long, seldom longer, like the pedicels more or less angular. Operculum traversed with four very smooth sutures often scarcely to be observed. Calyx-tube 2–3 lines long, hardly denticulate. Stamen-bundles alternating with the calyx-teeth, leaving behind an incurved tooth with a semiorbicular contracted base. Filaments white or yellowish; rose-coloured at the base, the longer ones 2½ lines long. Anthers pale, sub-ovate. Style barely a line long. The indurated fruit ⅓–½ inch long, with the mouth sometimes distinctly and sometimes not at all contracted, wrinkled. Sterile seeds yellow, less than a line long, angular; fertile seeds blackish, 1½–2 lines long, rhomboid-subovate, acutely angled, very narrowly and thinly winged near the margin.

The genus *Eudesmia*, if we except the disposition of the stamens, cannot be discerned from any species of Eucalyptus.

(The filaments, rose-coloured at the base, bring this species into the list of those which have bi-coloured filaments. It belongs to a group where the reddish colour is, like that of *E. Sieberiana*, not wholly diffused over the whole of the filament.)

The species is described in B.Fl. iii, 260, in the following words :—

A shrub, attaining 10 feet, with a smooth bark (*Oldfield*). *Leaves* from broad-lanceolate and 4 to 5 inches long, to narrow-lanceolate and shorter, mostly mucronate-acute and often falcate, rigid, the veins rather numerous but oblique and anastomosing, very conspicuous in the narrow leaves, much less so in the larger ones, the intramarginal one usually distant from the edge. *Peduncles* axillary, very short, nearly terete, mostly 3-flowered. *Peduncles* short. *Calyx-tube* narrow-turbinate, 2½ to nearly 3 lines long, with four minute teeth, sometimes prominent, sometimes scarcely conspicuous. *Operculum* short, depressed hemispherical, very obtuse and rather thick. *Stamens* 2 to 3 lines long, distinctly arranged in four clusters or bundles alternating with the calyx-teeth; anthers very small, nearly globular, with distinct parallel cells. *Fruit* ovoid or oblong, usually ½ to nearly ¾ inch long, in some specimens (perhaps not perfect), contracted at the orifice, but usually cylindrical, the rim concave, not broad, the capsule slightly sunk, usually 3-celled.

It is not dealt with by Mueller in his " Eucalyptographia,"

I published the following note concerning it in 1911 :—

A white gum, a smooth-barked straggling tree of 20 feet, with a diameter of 9 inches and very little scaly bark. As a rule seen as a bush. Wood pale chocolate brown towards the heart, but most of it white. Branchlets brown, giving the tree a brownish cast. Juvenile leaves lanceolar, rarely broad. Leaves pale-green, glaucous, equally green on both sides. Leaves in opposite stage to top of tree. It is the exception for them to be alternate. Fruits yellowish, quadrangular. I only came across it at Minginew, where it is rare. (*Journ. W.A. Nat. Hist. Soc.*, Vol. III.)

RANGE.

The type comes from sandy plains and limestone hills near the Murchison River, Western Australia. It was for many years believed to be confined to that State, but I show it to also occur in South Australia and the Northern Territory. It is a species of dry country. Drummond had previously collected it, under No. 69 (6th Collection).

The following two specimens were received from Mueller, and are doubtless typical :—

(*a*) Shrubby, 6–8 feet. Sand plain north of Mount Curious, Murchison River (Augustus Oldfield).

(*b*) " Eucalyptus ' Myallie ' of the aborigines (evidently the same as ' Mallalie ' in the original description), from Pindaryah, north of Murchison " (Augustus Oldfield).

" *E. eudesmioides* has been traced by the writer in 1877 from the Arrowsmith River to near Shark's Bay over sand and limestone ground " (Mueller, in " Eucalyptographia "). Found near Freycinet Harbour (Mueller, Shark Bay Report).

Following are additional localities :—

" Mallee, 10–12 feet high." Sand plains between Mogumber and Gillingarra (W. V. Fitzgerald). In another label on specimens from the same locality he says, " Sandy hillsides; stems smooth-barked."

Carnamah, Midland Railway line (Dr. A. Morrison).

Mt. Muggawah, Yandanooka, Arrowsmith River district (Dr. A. Morrison).

Small tree of 20–25 feet, Mingenew (W. V. Fitzgerald, J.H.M.). Shrub of 1½–3 metres, or small tree, young branches purplish, leaves glaucous. North of Mingenew (Dr. L. Diels, No. 3035).

The above localities are all at no great distance from the west coast; the following take a leap into the dry country easterly and we have no intermediate records.

" The fine growth of *Eucalyptus eudesmioides* (Desert Gum) extending for over 100 miles gave the country a very pleasing aspect." Vicinity of Queen Victoria Spring.

(*Journal Elder Expl. Exped.*, p. 7). The Spring is in 30° 30′ south latitude, and 123° 45′ east longitude, north-east of Kalgoorlie. We have other specimens collected by the same expedition, as follows :—

(*a*) Camp 45, Victoria Desert (R. Helms, Elder Exploring Expedition, 8th September, 1891).

(*b*) Victoria Desert (R. Helms, Elder Exploring Expedition, 2nd September, 1891), (labelled *E. Todtiana* by a slip of the pen). The following note refers to these specimens :—W.A., near Barrow Range, Victoria Desert (C. 45 and 60), " Desert Gum, 30–45 feet." (*Proc. Roy. Soc. S.A.*, xvi, 358). Barrow Range is approximately 26° south latitude, and 127° 20′ east longitude.

We are now approaching South Australia and the Northern Territory.

South Australia.

E. eudesmioides is shown in the map of the Elder Exploring Expedition over large areas in South Australia, and although I have not seen a South Australian specimen, I readily agree that it is found in that State, since it has been found in extra-tropical Western Australia adjacent to the South Australian border, and also in the Northern Territory not far from the South Australian boundary.

Mueller and Tate (*Proc. Roy. Soc. S.A.*, xvi, 358) record a " variety with ovate leaves, 25 miles S.S.W. of Mt. Watson." I have not seen the specimen and it would be desirable to re-examine it.

Northern Territory.

In the desert country (from the George Gill Range to Ayers Rock and Mt. Olga), at p. 81 of the Horn Expedition Narrative, Prof. Baldwin Spencer says, " All the morning we were traversing low sandhills, on many of which grew a fine sandhill gum, *E. eudesmioides*, which reached a height of 50 to 80 feet. The trunk is silver-grey in colour and very shiny, except the butt, where it is covered with a paper-like bark which peels off in long, yellow-brown scales. The grey-green foliage usually forms a kind of umbrella shaped mass, and it is somewhat strange to find a big tree like this right out amongst the waterless sandhills."

Tanami Goldfield is situated in North-western Central Australia in latitude 19° 58′ and east longitude 129° 45′ (approx. about 48½ miles east of the boundary between Western Australia and the Northern Territory. It is 696 miles (550 by track and 146 by railway) from Darwin, or 400 miles (by track *via* Mucka) from the Victoria River depôt.

In Mr. Lionel C. E. Gee's " General Report on Tanami Goldfield and district " (S.A. Parliamentary Paper, 1911)—from Tanami to Mucka on the Victoria River, Desert Gums (probably *E. eudesmioides*) were encountered (see p. 6 of Report).

AFFINITIES.

1. With *E. tetragona* F.v.M.

"Very near *E. tetragona* in characters, but the narrow leaves, small flowers and narrow fruits give it a very different aspect." (B.Fl. iii, 260.)

"The differences between *E. tetragona* and *E. eudesmioides* . . . consist in the much narrower leaves of *E. eudesmioides*, the absence of the waxy-powdery whiteness, less or not compressed flower-stalks, smaller flowers and fruits, prevailing ternary number of fruit-valves . . . A large fruited form of this plant from Esperance Bay, referred to *E. tetragona* in the 'Flora Australiensis' seems to mediate the transit from *E. tetragona* to *E. eudesmioides;* it is without whitish bloom, and may exhibit the aged state of the species." ("Eucalyptographia.")

No form, large-fruited or other, from Esperance Bay, is referred to *E. tetragona* in the "Flora Australiensis." Mueller is referring to a specimen in his own herbarium, as follows:—His label is "*Eucalyptus tetragona* F.M. (*Eudesmia*), Esperance Bay. Transit to *E. eudesmioides*. Flower stalks compressed."

Diels and Pritzel refer to it in the following passages:—

"*E. tetragona* F.v.M. We have seen a form with narrower lanceolate-elliptical leaves and less pruinose, collected in the eastern Eyre district near Israelite Bay (A. G. Brooks) in the Melbourne herb. This specimen seems analogous to the form, mentioned by Mueller in Eucalyptographia, as showing transit to *E. eudesmioides*, found near Esperance Bay. Still it seems to have much more affinity to *E. tetragona* than *E. eudesmioides*." (Diels and Pritzel in Engler Jahrb., xxxv, 444.)

This Esperance Bay specimen (*E. tetragona*, in my view), is referred to again by Dr. Diels in the following passage (translation):—

The species (*E. tetragona*) belongs from its fruits and flowers to the very small group of Eudesmieæ (Bentham Fl. Austr. iii, 258) and is there doubtlessly nearly related to *E. eudesmioides* F.v.M. (fig. 27). Nothing is more expressive of the close relationship of the two species than the different limits different authors draw to the forms of the two species. According to F. v. Mueller (Eucalyptographia) *E. eudesmioides* is distinguished by the alternate, much smaller leaves, the warting of the white waxy bloom, less or not at all flattened pedicels, and smaller flowers and fruits. A large-fruited form from Esperance Bay—so continues F. v. Mueller—which is placed by Bentham (B.Fl.) with *E. tetragona*, seems to represent a transition of the two; it has no white bloom and is perhaps the grown-up state of the species. With this F. v. Mueller admits that a form regarded by him as *E. eudesmioides* is perhaps the fully matured state of *E. tetragona*. I can only agree with this view after examining a specimen similar to the form in question collected by Miss Brooke at Israelite Bay. This plant is from the fruit entirely *E. tetragona*, but the leaves are partly alternate, smaller, without bloom, and the flowers are smaller, therefore a clear transition to *E. eudesmioides*, whose type, collected about 900 km. more northerly, is figured at fig. 27*d*. ("Jugendformen und Blutenreife," p. 94.)

This Esperance Bay specimen is figured at figs. 4*a-d*, Plate 188; see the description of the Plate given at page 183, where I express the opinion that it is *E. tetragona*, with fruits not quite ripe. It may be looked upon as starved. At the same time, I agree that it seems to show characters intermediate between *E. tetragona* and *E. eudesmioides*. Further, we must remember that it comes from country where *E. tetragona* is abundant, and *E. eudesmioides* absent, the latter being found in more northerly, much drier, country.

The chief differences between the two species are tabulated by me at page 137, Part XLV.

DESCRIPTION.

CCLXI. E. Ebbanoensis Maiden n.sp.

THIS species may be described as follows :—

Mallee 9″ diametro, fere 30′ alta, cortice læve; foliis maturis obscure viridibus, crassiusculis, lanceolatis, sæpe falcatis, venis indistinctis, tenuibus, patentibus, vena peripherica margini approximata; alabastris 3 in axillis pyriformibus, operculo brevi-hemispherico, ca. 5 mm. diametro; calycis tubo urceolato ad conoideo; staminibus 4 fasciculis dispositis; fructibus fere hemisphericis, fere 1 cm. diametro, margine latiusculo plano vel rotundato, valvis bene exsertis.

A tall mallee, usually between 12 and 20 feet high and 6 inches in diameter, but probably attaining a height of about 30 feet; stems near the ground about 9 inches in diameter. Bark smooth.

Juvenile leaves not seen.

Mature leaves usually alternate, dull green, the same on both sides, rather thick, with rather long petioles, lanceolate, often falcate, gradually tapering to the apex, not very rounded at the base, profusely dotted, venation indistinct, fine, spreading, the intramarginal vein rather close to the edge.

Flowers.—Buds in threes in the axils, brown, the peduncles rounded and about 1 cm. long, the pedicels short but distinct. Pear-shaped, the operculum shallow-hemispherical, about 5 mm. in diameter, the calyx-tube urceolate to conoid, and twice the depth of the operculum. Anthers versatile, with cream-coloured filaments, the cells opening in parallel slits with large gland at back; arranged in four bundles, alternating with the calyx-teeth.

Fruits hemispherical to truncate-pyriform, nearly 1 cm. in diameter, with a broadish, flat or domed rim, and with the valves (three) well exsert.

Type from Sandplain, Ebbano, east from Mingenew, Western Australia (Dr. A. Morrison, 28th September, 1904).

Figured at Figs. 6 and 7, Plate 189.

RANGE.

It is confined to Western Australia, so far as we know at present. The type comes from Ebbano (Ebano), about 12–15 miles east of Mingenew, a railway station 227 miles north of Perth and about 35 miles east of Dongarra on the sea coast. Comet Vale is on the Laverton line, and is 63 miles north of Kalgoorlie. The two localities are nearly 400 miles apart in a slightly south-easterly direction.

Following are details of the two specimens seen by me :—

"Sand Plain, Ebbano, east from Mingenew" (A. Morrison, 28th September, 1904). No further particulars. Dr. Morrison spelt the name with two "b's," but on the official map, obligingly forwarded by the Department of Lands and Surveys of Western Australia, the name is spelt with one "b." As Dr. Morrison's original spelling was Ebbano, and in some correspondence concerning this plant that spelling was adopted, I use the name *Ebbanoensis*, though with some doubt.

No. 115. No main trunk (mallee habit). Usually between 12 and 20 feet high; stem usually not more than 6 inches in diameter. Smooth bark. Many of the trees seen are re-growths. Original trees probably up to about 30 feet in height, and stems near the ground about 9 inches in diameter. Comet Vale (J. T. Jutson, No. 115, December, 1916; fruits, 25th March, 1917).

AFFINITY.

With *E. eudesmioides* F.v.M.

It is evidently closely related to this species. I have not juvenile leaves of the new species, but the two can be compared to some extent on perusing Plate 189. It seems to me that *E. eudesmioides* is a remarkably uniform species. *E. Ebbanoensis* differs from it sharply in the fruits, which are larger, inclined to be quadrangular, usually angled, with a thin rim and sunk valves. It also appears to be longer leaved and more free-growing. Both species are Mallees or small trees, and have their inflorescence in threes. The new species, while I believe it to be quite distinct, requires further investigation before we can fully define it.

XV. E. Andrewsi Maiden.

See the present work, Part VII, p. 194, Plate 36; also my "Forest Flora of New South Wales," Part XXI, p. 5, with Plate 79.

Although this is commonly known as "Blackbutt," and I have, therefore, to save confusion, proposed the name "New England Blackbutt" for it, it also passes under the names "Messmate," "Peppermint," and even "Stringybark" and "Woollybutt."

Shape of the fruit.—As figured at fig. 4, Plate 36, Part VII of this work, nearly hemispherical, slightly pear-shaped fruits, with nearly filiform pedicels are shown. At figs. 20–22, Plate XXXII of *Proc. Linn. Soc. N.S.W.*, xxiii, 1898, the fruits of *E. Sieberiana* var. *Oxleyensis* (which at p. 195, Part VII of this work, I have stated to be a synonym of *E. Andrewsi*), are shown to be so pear-shaped as to be almost conical. This conical form of the fruit is also shown in Mr. Baker's plate of *E. campanulata*, and also in figs. 5*g*, 5*h*, Plate 190, which have been drawn from Mr. Baker's type.

Turning to the more bell-shaped form of the fruit from which Mr. Baker gets his name *campanulata*, I have not a specimen so campanulate as that of fig. 5*f*, Plate 190, which is a facsimile of fig. 3 of Mr. Baker's plate of his type. I think it is just a trifle diagrammatic. The nearest I can get to it is fig. 4. This tendency to the campanulate form shows a closer approximation to the type of *E. Andrewsi* than to *E. campanulata* itself. What has misled Mr. Baker in proposing the species *campanulata* is too close a following of typical *E. Andrewsi* without bearing in mind the variation as exhibited in *E. Sieberiana* var. *Oxleyensis*, and his own figures 4 and 5 (reproduced by me as 5*g* and 5*h*). The drawings now submitted, viz., figs. 1, 2*b*, 4, 5*g*, and 5*h*, Plate 190, usefully supplement Plate 36 of Part VII, showing that in *E. Andrewsi* the range of the shape of the fruits is considerable, and varies from hemispherical to conical.

SYNONYMS.

1. ***E. Sieberiana*** F.v.M., var. *Oxleyensis* Deane and Maiden (1898).

2. ***E. campanulata*** R. T. Baker (1911).

1. This variety is fully described in *Proc. Linn. Soc. N.S.W.*, xxiii, 794 (1898), with figs. 20–22, Plate XXXII. See my comments at Part VII, p. 195 of the present work.

2. Mr. Baker's species is described in *Journ. Roy. Soc. N.S.W.*, xlv, 288 (1911), with Plate XIII.

Following is a copy of the original :—

EUCALYPTUS CAMPANULATA, sp. nov., " Bastard Stringybark."

An average forest tree. Bark decidedly stringy, persistent on the main trunk, branches smooth.

" Sucker " or abnormal leaves broadly lanceolate, oblique not shining, same colour on both sides, often over 9 inches long, venation well marked, lateral veins oblique, distant intramarginal vein well removed from the edge. Petiole over 1 inch long. Normal leaves comparatively small, lanceolate, oblique, subcoriaceous, not shining. Venation not at all well marked on the smaller upper leaves, but distinctly so in the others. Lateral veins very oblique.

Buds, clavate or club shaped, the operculum domed.

Fruits.—At the earliest stage of development campanulate on a slender pedicel, a feature not noticed in other species by us. Mature fruits pyriform, rim truncate or slightly countersunk, about 6 mm. diameter at the rim.

Bark " stringy " as implied in its common name.

Timber, light coloured or whitish, fissile, but close grained, easy working, in fact, similar in general characteristics to some of the " Ashes " or " Stringybarks," although perhaps a little more inclined to develop gum-veins.

Arbor (Bastard Stringybark), distincta, nomine altitudinem 60 feet, attinens, ramulis primum compresso-tetragonis mox teretiusculis.

Cortex partim secedens in trunco persistens ramis levibus.

Folia abnorme (suckers) obliqua falcato-lanceolata petiolata, alterna concoloria vena peripherica a margine remota; vena laterale obliqua graviter. Folia vulgare, falcato-lanceolata, obliqua, petiolata concoloria, alterna subcoriacea, vena aut prominentes aut obscura obliqua, pleraque 3–6″ longer.

Pedunculi axillare umbellis multifloris; operculo-depresso hemispherica, mucronulatato breviter, calycis tubus circa 1 cm. longus; fructibus truncato-ovatis, 1 cm. longi, 5 mm. lati valvis non exsertis.

Remarks.—The material of this tree for investigation was collected by Mr. C. F. Laseron, the Museum Collector, at Tenterfield, where it passes as the " Bastard Stringybark." His herbarium material appears to be identical with specimens collected by Mr. A. Rudder in the Upper Williams district.

The fruits somewhat resemble those of *E. virgata* Sieb. or *E. Sieberiana*, but then the timber, bark, and oil differ from these species. The oil of *E. virgata* consists almost entirely of eudesmol, as shown in our work on "The Eucalypts and their Essential Oils." Fruits, timber and oil differentiate it from *E. obliqua*, which species has been collected in almost the same neighbourhood, at Mount McKenzie, Tenterfield.

There is a distinguishing feature of the species in its very early fruits, which are quite bell shaped and remind one of the shape of the mature fruits of *E. Deanei*. As they mature, this shape passes gradually away, the calyx gradually tapering into a pedicel, very rarely is the fruit hemispherical.

On a cortical classification it would be placed with the " Stringybarks," or between them and the " Peppermints," but the timber may be classed as one of the " Ashes," such as *E. regnans*, *E. oreades*, or *E. Delegatensis*.

The large oblique suckers are not at all unlike those of *E. obliqua*, or even the above three species.

At Tenterfield it is found growing amongst such " Stringybarks " as *E. obliqua* and *E. lævopinea*.

RANGE.

This species is found in northern New South Wales and southern Queensland (chiefly on the tablelands and especially New England). A large number of localities are quoted at pages 195 and 196 of Part VII of the present work, and the following further records of specific localities in the National Herbarium, Sydney, will be more or less useful.

Mr. Forest Guard N. Stewart of Glen Innes, writing in January, 1909, made the following report in regard to his experience in New England, N.S.W. Further particulars in regard to the timber will be found at page 6, Part XXI, of my " Forest Flora of New South Wales."

This Blackbutt varies very much in quality according to soil and altitude, as I find that this timber growing on granite formation and at a high altitude is pale in colour and harder than the same timber at a lower altitude on soil of a basaltic formation. Where growing on the latter, the timber is generally of a pale brown colour, denser and heavier than the former, and the bark is of a more fibrous nature.

It appears to be very subject to gum-veins, although not to such an extent as to injure the timber. For house-building purposes it has been found to be very durable.

It has a wide range in this district from the Sara or Mitchell River on the south to Pheasant Creek on the north. I cannot find any of the same timber as far west as Emmaville. The Messmate of Emmaville and the Blackbutt of New England differ very much in quality, as the Emmaville timber is only used for temporary purposes as it is not durable, especially when it comes in contact with the ground, and it has too many gum-veins for house-building purposes. Blackbutt is never specified here for piles or in fencing contracts for obvious reasons, the principal one I think is that the Glen Innes people think there is no timber like stringybark or box for fencing purposes. I have examined piles of the New England Blackbutt in one building which I know has been erected twenty-four years, and they appear to be quite sound.

" Messmate," Coolpi Mountains, near Ellenborough Falls, *via* Wingham (J. L. Boorman).

Mt. Lindsay Station, Nandewar Mt., 3,200 feet (R. H. Cambage, No. 2347).

" A Mountain Box " (an improper name, J.H.M.). Southern flanks of Gleniffer Range, Gleniffer. (E. H. F. Swain, Nos. 220, 223). " Blackbutt," parish Vant, county Hawes. (E. H. F. Swain). " Stringybark," Dividing Range, county Parry. (E. H. F. Swain). Parish Scott, county Parry (E. H. F. Swain). Usually hollow, timber regarded as useless; Dungowan Creek, county Parry. Swamp Oak, parish Vernon, county Parry (Forest Guard M. H. Simon). " Stringybark," Nundle, county Parry (Forest Guard M. H. Simon, No. 9).

Fourteen feet in girth, parish Terregree, county Courallie, Moree district (E. H. F. Swain, Nos. 25, 38).

Timber valued for many purposes, Guy Fawkes (J. L. Boorman). " Woollybutt," Armidale district (District Forester Stopford).

" Blackbutt," State Forest No. 308, parish Robertson, county Gough, Glen Innes Forestry district (Forest Guard, specimen No. 20). See fig. 1, Plate 190. Pheasant Creek, Glen Elgin (J. L. Boorman).

" Peppermint," Marengo, counties of Gresham and Clarke (A. W. Deane, L.S.).

" Peppermint," Gundamulda, Warialda district (W. A. W. de Beuzeville, No. 5). " Woollybutt," Linton, Warialda district (W. A. W. de Beuzeville).

Smoky Cape, *via* Kempsey (J. L. Boorman).

Eastern Dorrigo, slopes towards Coff's Harbour (W. Heron).

" Blackbutt," Torrington (J. L. Boorman).

Summit of Beehive Mountain, Tooloom Station (Forest Guard W. Dunn, No. 369).

" Blackbutt," Tenterfield to Sandy Flat (J.H.M.). Tenterfield (C. F. Laseron, J.H.M.). Wallangarra (J. L. Boorman). Boonoo Boonoo, north-east of Tenterfield (R. H. Cambage, No. 3790). " Messmate," Wilson's Peak, Macpherson Range (J.H.M.).

Queensland.

Dalveen, near Stanthorpe (A. Sargent). "Stringybark," Springbrook, Macpherson Range (C. T. White).

AFFINITIES.

These are dealt with at Part VII, p. 196, but there may be added :—

1. *E. gigantea* Hook. f.

This species will be found dealt with at Part XX, p. 291, with Plate 85. As will be seen in comparing these illustrations with those in Plate 36, Part VII, and Plate 190, in both species we have very large juvenile leaves, although those of *E. gigantea* are the larger. Both are glaucous and exhale a delicious aroma from their leaves. The buds of the two species are not closely related, nor are the fruits, although those of fig. 2*b*, Plate 190, approximate to those of *E. gigantea*.

DESCRIPTION.

CCLXII. E. angophoroides R. T. Baker.

In *Proc. Linn. Soc. N.S.W.*, xxv, 676 (1900), with Plate xlvi, figs. 4a, 4b, 4c.

FOLLOWING is the original description :—

A medium sized tree with a white box bark persistent to the ultimate branches.

Sucker leaves ovate-acuminate, cordate, shortly petiolate, glaucous, variable in size from 1 to 3 or 4 inches long, and 1 to 3 inches broad; venation indistinct on both sides. Leaves of mature trees narrow lanceolate, about 6 inches long, acuminate, not shining, of the same colour on both sides; venation finely marked, oblique, spreading; intramarginal vein removed from the edge. Oil glands numerous.

Peduncles axillary, 3 to 4 lines long, slightly compressed, bearing a few flowers. Calyx hemispherical to pyriform, 1 line long. Pedicel about 1 line long. Operculum hemispherical, shortly acuminate Ovary domed. Stamens all fertile; anthers parallel, opening by longitudinal slits.

Fruits hemispherical to slightly pear-shaped, 2 lines in diameter and under 4 lines long; rim thick, sloping outwards—a ring just below the edge; valves generally 4, exserted under 1 line.

The author calls it " Apple-top Box," and adds " *E. Bridgesiana* Baker, partim."

For a reference to *E. Bridgesiana* Baker, see p. 68, Part XXIV.

RANGE.

It is confined to the southern coastal district of New South Wales, and may be expected to be found in eastern Gippsland, Victoria.

" Colombo, N.S.W. (W. Baeuerlen); Towrang, N.S.W. (R. T. Baker). It is quite limited in its distribution, and presents no difficulty of determination in the field." (Original description.)

Colombo is on the Bemboka River amongst the hills. It is no great distance west of Bega, and therefore in county of Auckland, in the extreme south-east of this State. The Wyndham locality, to be quoted later, is south-west of Colombo, and in the same county. Nangutta is somewhat further south. Yourie to be referred to later is in the county of Dampier, also a coastal county, and a little north of the county of Auckland.

Towrang is a railway station 126 miles from Sydney, 8 miles north of Goulburn, and this locality is important since it yielded the oil attributed to this species which Messrs. Baker and Smith (" Research on the Eucalypts," p. 144) examined.

The following note bears on the apparently dubious Towrang locality :—

"Some years ago I received from Mr. Baker specimens (in bud) from Towrang, which he attributed to this species, and which I attributed to *E. Stuartiana* F.v.M. var. *parviflora*, and still hold that view." (Figured at figs. 3 and 4, Plate 102, Part XXIV, J.H.M.)

"Recently, having received certain specimens from Mr. R. H. Cambage, which had been collected by Mr. E. C. Andrews at Wyndham, on the Pambula-Bombala road, I went into the matter again, and find that they are identical with Mr. Baker's *Colombo* specimens, and I agree with him as to the validity of his species so far as the Colombo specimens are concerned. Further search at Towrang reveals no *E. angophoroides*, but confirms the previous determination of *E. Stuartiana*.

"The error is to be regretted, and I would point out the inconvenience of giving more than one locality for a type.

"The combination of the two species is perpetuated in my notes of *E. Stuartiana* F.v.M. at page 68, Part XXIV of my 'Critical Revision of the genus Eucalyptus,' now in the press, but the type was distributed before I could point out the confusion." (Maiden in *Journ. Roy. Soc. N.S.W.*, xlix, 322, 1915.)

Mr. E. C. Andrews, now Government Geologist of New South Wales, favoured me with the following note on the abovementioned Wyndham locality, as follows :—

"Mr. Cambage has said you would like to know the area from which I collected the Eucalyptus when visiting the Whipstick mines. Enclosed please find sketch of locality at 16 miles to inch (not reproduced). The plants grow thickly alongside *main* road between Wyndham and Whipstick, the two being 4 miles apart. *E. Sieberiana* flourishes on the siliceous granites and the Devonian sediments at Whipstick, one tree being 100 feet to the first limb and about 6 to 8 feet in diameter. The Eucalyptus (*angophoroides*) with the peculiar seedlings, leaves, and sapling foliage grows especially on the Devonian sediments and basic granite. Its mates are *E. goniocalyx*; *E. Bosistoana*, &c. *E. coriacea* is there also at Candelo and a few miles west of Wyndham." (Letter of 22nd July, 1915.)

Mr. W. Baeuerlen also collected it at Nangutta, near Eden.

I have also received this plant under the name of "Cabbage Box," from Mr. William Dunn, from Yourie, about 30 miles westerly from Bermagui, on the Tuross waters. The locality is useful, as we do not at present know the range of this species. This is in the county of Dampier.

"Mr. Baker's tree appears to be only found in and around Yourie as far as I can learn. I called on Mr. Gough, an old resident of that locality, and he states he does not know of any other locality that the tree may be found. The specimen of the bud, &c., were obtained from two separate trees, one of which is fully 8–9 feet in circumference and with a clean barrel of 38–48 feet." (Forest Guard William Dunn of Bermagui). Mr. Dunn is mistaken about his locality being unique, but the statement is evidence that the tree is not well known yet, and probably not very abundant. What its focus or *optimum* locality is, we do not yet know.

AFFINITIES.

1. With *E. Stuartiana* F.v.M. (*E. Bridgesiana* R. T. Baker).

"The herbarium material of this species is so similar to that of *E. Bridgesiana* that on my first examination it was included under that species.

"My field observations since that date, and the acquisition of further material such as timber and oil, have convinced me that the two trees are quite different, and should not be included under the same name. Mr. W. Baeuerlen, indeed, who has known the trees for very many years, has always held that the two were different in specific characters.

"*E. Bridgesiana* is known vernacularly as 'Apple' and 'Woolly-butt,' but this tree as 'Apple-top Box.' As stated above, the foliage, fruits, and flowers certainly resemble those of the former species, but there the similarity ends. The bark is a true box-bark, but the timber is quite unlike that of a box. . . .

"The bark has not an essential oil as pertains to *E. nova-anglica* and *E. Bridgesiana*.

"Although it has a regular light-coloured grey box bark, yet the appearance of the tree is more like that of an 'Apple-tree' (*Angophora*), hence the local name of 'Apple-top Box.'

"(It has) 'A pale-coloured, soft, specifically light timber, open in the grain, and perhaps to be regarded as porous. It has not the broad sapwood of *E. Bridgesiana* Baker. It seasons well, and is suited for cabinet work, as it closely resembles in colour, weight, and texture the timber of *Angophora intermedia* DC. It is much superior to that of *E. Bridgesiana*." (Original description.)

For *E. Stuartiana* see Part XXIV, plates 101 and 102, when it will be seen that the resemblance between the two species is considerable. The closest resemblance is to var. *grossa*, which has the coarsest juvenile foliage in the species. Morphologically it is not easy to separate the two species, but they differ, as Mr. Baker has pointed out, in timber and oil; also in their canopies, to mention no other differences.

2. With *E. elæophora* F.v.M. (*E. Cambagei* Deane and Maiden).

"It differs from *E. Cambagei* Deane and Maiden, in the superiority of its timber and the inferiority of its oil, and the shape of its fruits; and from *E. nova-anglica* Deane and Maiden in the bark, colour of timber, and oil." (Original description.)

For *E. elæophora* see Part XIX, Plates 82 and 83. In *E. angophoroides* the juvenile leaves are more uniformly rounded, and the large intermediate leaves are common and characteristic. In *E. elæophora* the operculum is, as a rule, only half the length of the calyx-tube, while the fruit is sessile, cylindroid, and, as a rule, angled or ribbed. At the same time the fruits of the two species are sometimes sufficiently similar as to necessitate caution.

Miscellaneous.

"It has little affinity with such Boxes as *E. hemiphloia* F.v.M., *E. Woollsiana* Baker, *E. conica* Deane and Maiden, *E. pendula* A. Cunn. (*E. largiflorens* F.v.M.), although it appears to be a connecting link with these and what are known as Bastard Boxes such as *E. Cambagei* Deane and Maiden, and *E. bicolor* A. Cunn." (Original description.)

What *E. Woollsiana* R. T. Baker is, will be stated in Part XLVII after reproduction of all the Plates, and revision of the evidence. It is a synonym, in my view. *E. bicolor* A. Cunn. is a western New South Wales species with reddish brown timber, and very different from *E. angophoroides*. It has *E. pendula* A. Cunn. and *E. largiflorens* F.v.M. as synonyms, and has been more than once shown in the present work.

DESCRIPTION.

CCLXIII. E. Kybeanensis Maiden and Cambage.

In *Journ. Roy. Soc. N.S.W.*, xlviii, 417 (1914).

Following is the original description :—

Arbor Mallee similis, 6–10′ alta, caulibus lævibus viridibus, ligno pallido. Folia juvena lanceolata circiter 6 cm. longa, 1 cm. alta, non-glauca, subtus pallidiore-virentia, margine crassata, costa media prominente, venis lateralibus prominentibus et fere pinnatis. Folia matura coriacea, lanceolata circiter 6–8 cm. longa, 1·5 cm. alta. Alabastra operculis hemisphericis diametro circiter conoideo calycis tubo dimidio equilongis. Flores renantheri. Fructus sessiles, ad 7 in capito, fere hemispherici, diametro fere 1 cm., orificio leniter rotundati, valvarum apicibus orificio aequis.

Species cum *E. stricta* affinitate trahitur, fructibus autem maxime diversis et *E. capitellatæ* Sm. similibus, qua magna " Stringybark," est.

Of mallee-like growth, 6 to 10 feet high, with smooth, greenish stems 1½ inches in diameter. Timber pale coloured.

Juvenile leaves.—Lanceolate, about 6 cm. long by 1 cm. broad as the alternate stage is reached, very shortly petiolate, non-glaucous, of a brighter green on the underside. Margin thickened. Midrib prominent and raised, showing a depression on the upper page of the leaf, the lateral veins prominent and roughly pinnate, intramarginal vein well removed from the edge.

Mature leaves rather coriaceous, lanceolate, about 6–8 cm. long by 1·5 cm. broad, erect, shortly petiolate, equally green on both sides. Veins fairly prominent and spreading from the base; intramarginal vein a considerable distance from the edge.

Buds.—Externally rough in texture, operculum hemispherical, the diameter about half the length of the conoid calyx-tube.

Flowers.—Renantherous.

Fruits.—Sessile, up to seven in the head. Nearly hemispherical, nearly 1 cm. in diameter, rim broad and reddish-brown, gently domed, tips of valves flush with the orifice.

The above was drawn up from the type, collected at Kybean on the Monaro.

Following is a description of a specimen from Blackheath, Blue Mountains, N.S.W., designated as " C," and looked upon by us as a hybrid of *E. stricta* Sieb. It is briefly referred to in Part IX, p. 283, of the present work.

" C.—A sapling tree, say 4 inches in diameter and 12 feet high. One small clump also seen.

Juvenile leaves.—Not seen in the earlier stage, but in what may be termed the intermediate stage. In that stage they are oval or oblong, and say 1½ inch long by ½ inch broad and profusely dotted with oil glands.

Mature leaves bright green, rather coriaceous. Veins fairly prominent, and spreading from the base; intramarginal vein a considerable distance from the edge. Tips of the leaves hooked as a rule. Reminds one of foliage of *E. stricta*, amongst which it grows, though the venation is probably more prominent than that of *E. stricta*

Buds numerous, pointed and in heads, giving it a stellate aspect. Hardly so clavate as those of *E. stricta*, but not seen ripe. Four to ten in the umbel.

Flowers.—Expanded ones not seen.

Fruits in dense heads, the common peduncle up to a quarter of an inch, pedicels absent. Individual fruits rarely hemispherical, slightly compressed at the base, rim broad and reddish-brown, slightly domed, tips of valves flush with the orifice.

Bark smooth, very long ribbons.

Timber pale-coloured.

Affinities.—The surrounding species are *E. stricta* Sieb.; *E. Sieberiana* F.v.M.; *E. Moorei* Maiden and Cambage; and *E. Gunnii* Hook. f. var *maculosa* Maiden (*E. maculosa* R. T. Baker). It has already been pointed out that the foliage resembles that of *E. stricta*. The buds exhibit slight resemblances at least to *E. stricta* and to *E. Gunnii* var. *maculosa*, particularly to the former, but the affinity of the fruit is not at present obvious, though they are suggestive of some forms of both *E. capitellata* and *E. eugenioides*, to which trees our plant has otherwise not the slightest resemblance, and it may turn out to be a good species." (*Proc. Linn. Soc. N.S.W.*, xxx, 201, 1905.)

RANGE.

Confined to New South Wales, so far as we know at present, but it may be expected to be found in north-eastern Victoria.

The type grew on sandy conglomerate formation at Kybean, amongst *Casuarina nana* Sieber, near the Kydra Trigonometrical Station, on the Great Dividing Range, 4,000 feet above sea-level, 16 miles easterly from Nimitybelle, near Cooma (R. H. Cambage, 4th November, 1908.)

The plant already referred to at "C" was collected at Blackheath in a high part of the Blue Mountains.

AFFINITY.

1. With *E. stricta* Sieb., and other species.

Unfortunately the material of *E. Kybeanensis* is scanty, so that the last word has not been said in regard to its relationships. It is shrubby, almost Mallee-like. In this respect and to some extent in the seedlings, it has relations to *E. stricta*. In the somewhat straight venation of the juvenile leaves it shows affinity to the *E. coriacea* group, and in the fruits to the *E. capitellata* group. It certainly requires further investigation.

DESCRIPTION.

CCLXIV. E. eremophila Maiden.

In *Journ. Roy. Soc. N.S.W.*, liv, 71 (1920).

FOLLOWING is the original description :—

Frutex vel arbor mediocris, cortice læve, squamosa, ramulis glaucescentibus; foliis junioribus angusto-lanceolatis, vel lanceolatis; foliis maturis lineari-lanceolatis ad lanceolatis, coriaceis, nitentibus, venis secondariis tenuibus sed remotiusculis, non pennivenis; pedunculis elongatis, applanatis, pedicellis fere teretibus ca. 5 mm. longis, calycis tubo oblongo vel cylindroideo, turbinato, ca. 5 mm. longo; operculo cornuto calycis tubo ca. quinquies aequilongo, diametro distincte minore, filamentis antherisque Cornutis similibus; fructibus cylindroideis vel sphæricis, calycis tubo crasso, capsulæ apice applanato fere margini aequante, fructu truncato.

A shrub or medium-sized tree, with smooth scaly bark. Branchlets glaucescent.

Juvenile leaves (suckers) not available in the earliest stage, but probably narrow. Those of the seedlings are narrow-lanceolate to lanceolate.

Mature leaves linear-lanceolate to lanceolate, coriaceous, shiny, not glaucescent, the secondary veins fine but rather distant and, at all events in the intermediate stage, spreading and roughly parallel, not feather-veined.

Peduncles elongate, flattened, pedicels nearly terete, distinct, about 5 mm. long.

Calyx-tube oblong or cylindroid turbinate, about 5 mm. long.

Operculum sometimes coloured (reddish), straight or horn-shaped, up to five times as long as the calyx-tube and much less in diameter. Filaments yellowish, sometimes crimson, angular, glandular, and with anthers as in the Cornutæ.

Fruits cylindroid to spherical; top of the capsule nearly flush with the rim, giving the fruit when not fully ripe a characteristically truncate flattish appearance. When the fruit is ripe its mouth becomes rounded and somewhat contracted.

As it is figured as indicated below, further illustrations do not appear to be necessary at this place.

SYNONYM.

E. occidentalis Endlicher var. *eremophila* Diels, in Engler's Jahrb., XXXV, 442, 1905.

See also this work, Part XXXVI, p. 147. Figured at Plate 149, figures 7–11 of the same work.

The relations of *E. occidentalis* Endl. var. *grandiflora* Maiden (Part XXXVI, p. 149, and figures 1 and 2, Plate 150) to *E. eremophila* remain a matter for further consideration.

RANGE.

It is confined to Western Australia so far as we know at present, but it is quite possible that it may occur in western South Australia. This is a dry country form, and its range may be stated as bounded by Watheroo on the Midland Railway, to 140 miles east of Kalgoorlie, and north of Esperance and back again to the vicinity of the Great Southern Railway. It probably has a very extensive range in country of low rainfall.

"Shrub 4 metres high, flowers yellow, calyptra (opercula) reddish." Near Coolgardie (Dr. L. Diels, No. 5237). Coolgardie, or rather Boorabbin (E. Pritzel, No. 917). I have also received it from Coolgardie (L. C. Webster). The type comes from Coolgardie. Other localities are quoted, *op. cit.*, p. 148.

AFFINITIES.

It is a member of the Cornutæ.

1. With ***E. occidentalis*** Endl.

It is sharply separated from this species in its narrow juvenile foliage, that of *E. occidentalis* being broad. Those of the former are shiny, with more numerous oil dots. Buds usually longer, hence with longer filaments; staminal disc broader. The fruit of *E. occidentalis* is campanulate, while that of *E. eremophila* is cylindroid or inclining to hemispherical.

2. With ***E. platypus*** Hook.

Here I invite attention to the similarities and dissimilarities I have brought forward at pages 151 and 152 of Part XXXVI of the present work.

DESCRIPTION.

LXX. E. decipiens Endl.

(Synonym *E. concolor* Schauer, No. LXIX.)

If my readers will turn to *Journ. Roy. Soc. N.S.W.*, liv, *Proc. Dec.*, 1920), there will be found a brief note recording that I drew attention to the confusion that has gathered around *E. concolor* in the same Journal, Vol. XLVII, p. 231 (1913). I have carried the matter a stage further in the present work, Part XLII, page 66. I have now received admirable specimens from Mr. C. A. Gardner, who is collecting on behalf of Mr. C. E. Lane-Poole, the Conservator of Forests of Western Australia. His specimens come from Spearwood, near Fremantle, Western Australia, are complete, and supply the missing evidence that *E. concolor* is specifically identical with *E. decipiens*.

At the top of p. 67 I suggested "it may turn out that *E. concolor* is the Fremantle form of *E. decipiens*." Mr. Gardner's specimens prove this, and we are therefore justified in suppressing *E. concolor* Schauer as a separate species. Not only has the conclusion been arrived at by the direct evidence of field observations, but the result is confirmed by seedlings raised from seeds from various localities, and grown in the Botanic Gardens, Sydney.

Mr. Gardner's description of the Fremantle tree, which follows, is valuable, that while *E. decipiens*, it is *E. concolor*, and from practically the type locality.

Eucalyptus decipiens Endl.—A tree attaining 30 to 50 feet, but usually much less, the branches spreading or almost pendulous, and very much like *E. gomphocephala* DC. in appearance. Bark thick, persistent and rough, of an ash-grey colour, the bark of the upper portions sometimes smooth.

Leaves variable in shape and size. Sucker leaves opposite or alternate, obcordate or almost orbicular, 2–3 cm. long and as broad, glaucous, the midrib scarcely conspicuous, the veins at an angle of 45 degrees to the midrib, the intramarginal one at a distance from the edge. Adult leaves ovate-lanceolate or lanceolate, undulate, slightly falcate, coriaceous and shining, about 9 cm. long, the midrib conspicuous, the intramarginal vein distinct and usually about ·2 cm. from the edge.

Peduncles lateral, terete and thick, ·8 cm. long, bearing a dense sessile head of 6 to 9 flowers. Calyx-tube broadly turbinate, ·5 cm. long and as broad. Operculum conical as long as the calyx-tube, obtuse, the line of separation distinct. Stamens inflected in the bud, filaments white, filiform, terete or slightly flattened at the base ·7 cm. long, anthers globular. Ovary conical, style thickened at the base, about ·6 cm. long, tapering.

Fruit broadly turbinate or campanulate ·5 cm. long and about as broad. Capsule sunk beneath the prominent truncate rim, the points of the valves slightly protruding.

Collected at Spearwood near Fremantle in limestone on low hills near the sea. Some of the young trees grow in dense patches, are erect, and might in appearance suggest a mallee. Coll. C. A. Gardner, 14th September, 1920.

APPENDIX.

Eucalyptus cochinchinensis Auct.

In Part I, p. 18 of the present work, there is a list of some non-eucalypts described as Eucalypts. The following may be added.

The late Dr. C. B. Robinson, the well-known botanical explorer of the Philippine Bureau of Science, Manila, wrote to me on 10th April, 1911, "In the Botanic Gardens at Saigon, I was shown a plant under the name of *Eucalyptus cochinchinensis*, and told that it is very common both in Cochin China and Cambodia. Subsequently I found it in great abundance in southern Annam. However, I believe it to be a *Melaleuca*. It may interest you, as it has been referred to Eucalyptus."

Dr. E. D. Merrill, of the Bureau, sent me the following specimens :—

1012. C. B. Robinson, 8–3–11, as above. It is *Melaleuca Leucadendron* L.

1092. C. B. Robinson, 12–3–11. *Melaleuca leucadendron* L. Nha-trang, Annam. "A tree 4 m. high, growing at an altitude of 2 metres."

Explanation of Plates (188–191).

PLATE 188.

E. tetragona F.v.M.

A. (Lanceolate-leaved series, with rather long petioles. It is not possible to make a sharp line of demarcation, as the leaves are transitional from lanceolate to ovate, but there is a certain amount of convenience in the grouping.)

1*a*, 1*b*. Juvenile leaves, from the original plate of *Eudesmia tetragona* R.Br. in *Appendix to Flinders' Voyage*, ii, 599, t. 3.

2. Buds, from shrub of 15 feet, Murchison River. (Augustus Oldfield.)

3*a*. Leaf and fruits; 3*b*, fruit, end on. Drummond's No. 69.

4*a*. Buds; 4*b*, leaf with fruits; 4*c*, fruit, as ripe as is available; 4*d*, fruit, end on. Esperance Bay (Correspondent of Mueller). This is the "transit to *E. eudesmioides*," of Mueller, and is the specimen referred to by Mueller at p. 168, and by Diels and Pritzel at p. 168. The fruits are not quite ripe, and therefore imperfectly ribbed; this, I think, has contributed to the confusion concerning this specimen.

B. (Ovate-leaved series, with rather short petioles.)

5. Juvenile leaves, showing stellate-hairs. Kalgan Plains, near Mount Stirling Range. (J.H.M.)

6*a*. Apparently mature leaf; 6*b*, buds; 6*c*, front and back views of anther; 6*d*, flower in elevation; 6*e*, flower in plan, showing four bundles of stamens. Esperance. (J.H.M.)

7. Leaves and buds. (Drummond's 4th Collection, No. 75.) (See also Plate 189.)

PLATE 189.

E. tetragona F.v.M. (concluded).

1*a*. Leaf and fruit; 1*b*, fruit. (Drummond's 4th Collection, No. 78.)

2*a*. Fruits; 2*b*, fruit, end on. Stirling Range (Louis Dillon). These are the largest fruits I have seen in the species.

E. eudesmioides F.v.M.

3*a*. Juvenile leaves (not in the earliest stage); 3*b*, buds; 3*c*, mature leaf and flowers; 3*d*, enlarged flower, in elevation; 3*e*, three views of anther; 3*f*, fruits.

In considering 3*d*, which is enlarged, it will be observed that the top of the calyx-tube has not the sunk appearance which is observable in the fruit. The explanation is that the calyx-tube increases in length as ripening proceeds, but the disc remains stationary. The calyx-teeth eventually become absorbed or dry up and break off. I have seen one of these four teeth alone remaining on the fruit. From Mount Curious, Murchison River (Augustus Oldfield). The type.

4. Fruits, more angled than usual. Mingenew. (W. V. Fitzgerald.)

5*a*, 5*b*, 5*c*, 5*d*, 5*e*. Various stages of juvenile leaves, 5*a* being in the earliest stage, while 5*e* is most mature, but not as mature as 3*c*. All from Mingenew. (J.H.M.) Mingenew is on the Midland Railway Line (Perth to Geraldton), and is 227 miles north of Perth.

E. Ebbanoensis n.sp.

6*a*. Mature leaf; 6*b*, flowers; 6*c*, fruits. Sand Plain, Ebbano, east from Mingenew. (Dr. A. Morrison.) The type.

7*a*. Mature leaf and buds; 7*b*, three views of anther; 7*c*, fruits. Comet Vale, 63 miles north of Kalgoorlie. (J. T. Jutson.)

PLATE 190.

E. Andrewsi Maiden.

1. Fruits, pear-shaped and domed. From State Forest No. 308, parish Robertson, county of Gough, N.S.W. (Forest Guard's specimen, No. 20, June, 1903.)

2*a*. Front and back views of anthers; 2*b*, larger, pear-shaped fruits. These are up to fourteen in the head from this locality. 2*c*, leaf in an intermediate stage. Boonoo Boonoo, Tenterfield District. (J. L. Boorman.)

3. Fruits, nearly hemispherical and slightly domed, taken from the type specimen. Tingha, N.S.W. (R. H. Cambage.)

4. Fruits, flat-topped, nine in the head, taken from a co-type. Howell, near Tingha. (J.H.M.)

5*a*. Juvenile leaf, almost in the intermediate stage; 5*b*, mature leaf; 5*c*, buds; 5*d*, flowers, showing styles and stigmas; 5*e*, front and back views of anther; 5*f*, campanulate young fruits, a trifle diagrammatic; 5*g*, fruits; 5*h*, single fruit, both it and 5*g* being pear-shaped to conoid. Tenterfield, N.S.W. (C. F. Laseron). All drawn from type specimens of *E. campanulata* R. T. Baker, 5*a*, 5*b* being drawn from type specimens supplied by Mr. Baker, the remainder being reproduced from Mr. Baker's drawings of the type, Plate XIII, Vol. XLV, *Journ. Roy. Soc. N.S.W.*

I cannot separate leaves, buds, fruits, nor any other organs of *E. campanulata* from *E. Andrewsi*, and what has doubtless misled Mr. Baker in my drawings of the type of the latter in Plate 36 of the present work is the greater width of the juvenile leaf (he only depicts an intermediate leaf), and the almost hemispherical fruits, which are only one amongst several varying shapes.

PLATE 190—*continued.*

E. angophoroides R. T. Baker.

(See also Plate 191.)

6*a*. Juvenile leaf; 6*b*, intermediate leaf; 6*c*, mature leaf; 6*d*, buds; 6*e*, fruits. "Apple-topped Box," Colombo, Bega District, N.S.W. (W. Baeuerlen.) The type.

7. Fruits, not domed, "Cabbage Box." Nangutta, near Eden. (W. Baeuerlen.)

8*a*. Buds; 8*b*, front and back view of anther; 8*c*, fully ripe fruits. Yourie, *via* Bermagui. (Forest Guard William Dunn.)

9*a*, 9*b*. Juvenile leaves, quite small; 9*c*, intermediate leaf (compare with 6*b*). Wyndham, near Eden. (J. L. Boorman.) For some other specimens belonging to the same locality showing further variation of leaves in this species, see Plate 191.

PLATE 191.

E. angophoroides R. T. Baker (concluded).

1*a*, 1*b*. Different stages of intermediate leaves, to be compared with those on the preceding Plate. Wyndham, N.S.W. (J. L. Boorman.)

2. Perhaps the largest intermediate leaf I have seen in this species. Wyndham (E. C. Andrews per R. H. Cambage.)

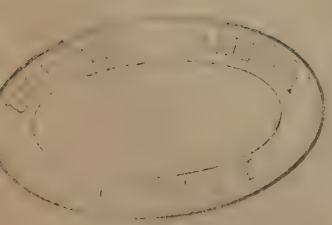
E. Kybeanensis Maiden and Cambage.

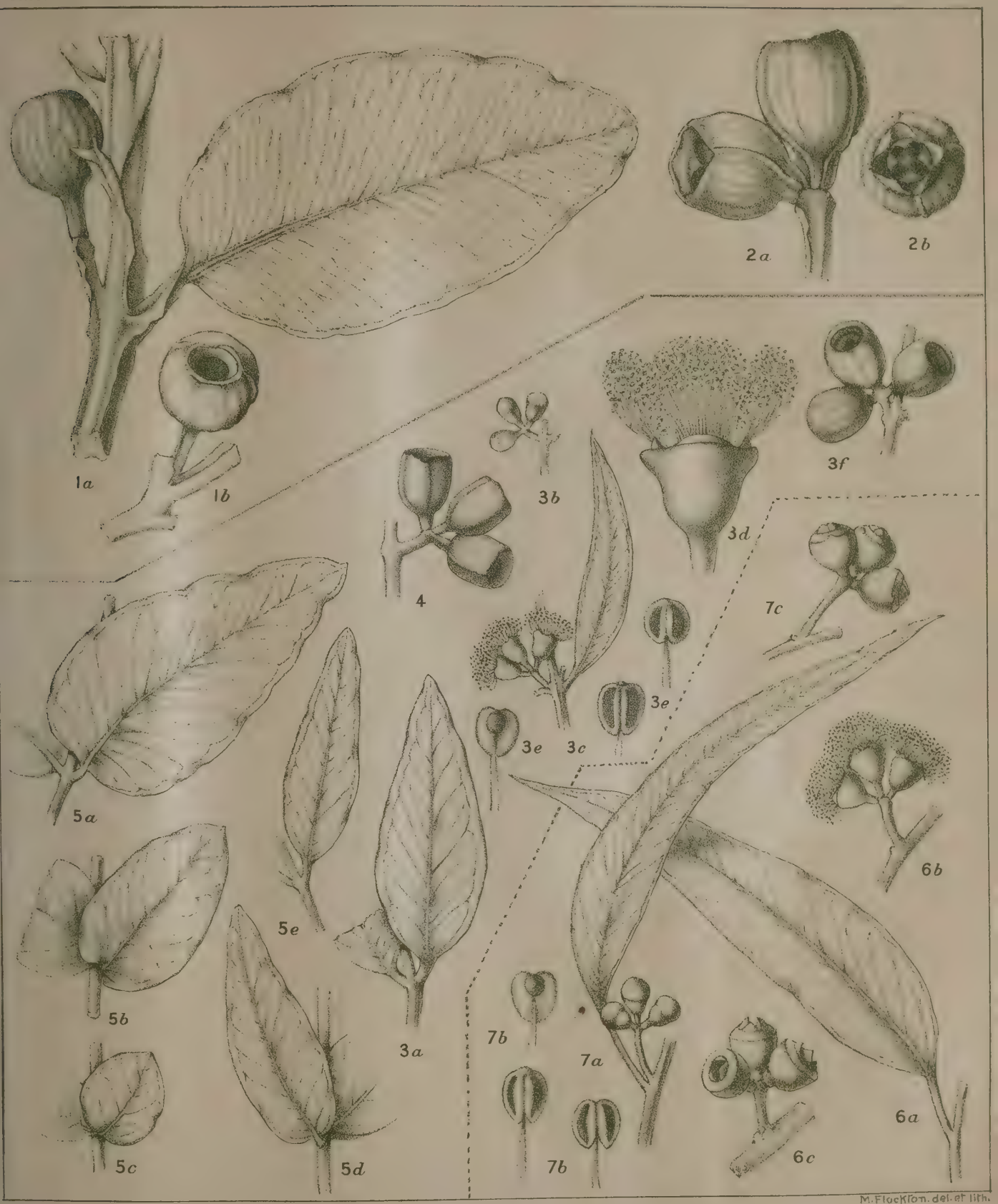
3*a*. Mature leaf; 3*b*, young buds with rounded opercula; 3*c*, front and back views of anther; 3*d*, fruits on a rachis square in section, which is unusual in fruiting specimens in Eucalyptus. This species is therefore one of the few which flower when the foliage is in the juvenile stage. Kybean, Monaro, N.S.W. (R. H. Cambage.) The type.

4*a*, 4*b*. Juvenile leaves (N.B., the mature leaf is similar to 3*a*); 4*c*, very young buds, with pointed opercula; 4*d*, 4*e*, fruits. Blackheath, Blue Mountains, N.S.W. (R. H. Cambage and J.H.M.)

At one time labelled C, and looked upon as a hybrid of *E. stricta* Sieb. See Part IX, p. 283.

EUCALYPTUS TETRAGONA F.v.M. [See also Plate 189.]





EUCALYPTUS TETRAGONA F.v.M. (*1, 2*) [See also Plate 188.]
EUCALYPTUS EUDESMIOIDES F.v.M. (*3–5*)
EUCALYPTUS EBANOENSIS MAIDEN n.sp. (*6, 7*)

EUCALYPTUS ANDREWSI MAIDEN (*1–5*) [See also Figs. 1–4, Plate 36]
EUCALYPTUS ANGOPHOROIDES R. T. BAKER (*6–9*) [See also Plate 191.]

EUCALYPTUS ANGOPHOROIDES R. T. BAKER (*1, 2*) [See also Plate 91.]
EUCALYPTUS KYBEANENSIS MAIDEN and CAMBAGE. (*3, 4*)

The following species of Eucalyptus are illustrated in my " Forest Flora of New South Wales"* with larger twigs than is possible in the present work; photographs of the trees are also introduced wherever possible. Details in regard to their economic value, &c., are given at length in that work, which is a popular one. The number of the Part of the Forest Flora is given in brackets :—

acacioides A. Cunn. (xlviii).
acmenioides Schauer (xxxii).
affinis Deane and Maiden (lvi).
amygdalina Labill. (xvi).
Andrewsi Maiden (xxi).
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A Critical Revision of the genus Eucalyptus

BY

J. H. MAIDEN, I.S.O., F.R.S., F.L.S.

(Government Botanist of New South Wales and Director of the Botanic Gardens, Sydney).

Vol. V. Part 7.

Part XLVII of the Complete Work.

(WITH FOUR PLATES.)

"Ages are spent in collecting materials, ages more in separating and combining them. Even when a system has been formed, there is still something to add, to alter, or to reject. Every generation enjoys the use of a vast hoard bequeathed to it by antiquity, and transmits that hoard, augmented by fresh acquisitions, to future ages. In these pursuits, therefore, the first speculators lie under great disadvantages, and even when they fail, are entitled to praise."

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DESCRIPTION.

CCLXV. E. Laseroni R. T. Baker.

In *Proc. Linn. Soc. N.S.W.*, xxvii, 585 (1912), with Plate LXIII.

FOLLOWING is the original description :—

Arbuscula usque ad 35′ alta. Cortex fibrosus, tam in ramis quam in trunco persistens, viridis, et hinc "Bastard Stringybark." Folia 3–5″ longa, fere 1–2″ lata, lanceolata, ovata, alternata subcoriacea, concoloria; venis patentibus, peripherica a margine remota, venulis obliquatis. Pedunculi ¼″ longi, axillares, solitarii, 10–15 flori. Fructus ¼″ longi, pilulares; margine convexo, valvis non exsertis. . . .

It is a small tree, 35 feet high and 1 foot in diameter, as far as seen. The fibrous bark covers the trunk, and decorticates in long strips from the main branches, which are otherwise smooth, but darker than in *E. stellulata*. The timber is yellowish-brown, and tough to cut, but brittle. . . . From the specimens seen, this is not a good timber. It is fairly close-grained, of a pale colour, but the presence of gum veins will militate against its general utilisation by the commercial world.

A small tree under 40 feet high, and about 1 foot in diameter, with a fibrous but hard stringy bark, in the general acceptation of the letter term.

Abnormal (juvenile) leaves ovate, lanceolate, slightly falcate in some instances, petiolate, attenuate, varying in size up to 5 inches long, and up to 2 inches broad. Normal leaves lanceolate, alternate, subcoriaceous, average leaves under 4 inches long and 1 inch wide, occasionally shining. Venation distinctly marked, the basal lateral veins sometimes running the whole length of the leaf, and well removed from the edge; the other lateral veins not so oblique, more transverse.

Buds in clusters, on axillary peduncles about ¼ inch long. Operculum sharply conical.

Fruits hemispherical, capitular, rim domed, valves scarcely or not exserted, ¼ inch in diameter, pedicel varying in length up to 2 lines long.

RANGE.

"This tree, so far, is known only from the Black Mountain district, where Mr. Laseron obtained material in July, 1907. He states in his field-notes that it is regarded locally as a cross between "Silver-top Stringybark," *E. lævopinea*, and "Sally," *E. stellulata*. A few trees are to be found on a rough rocky basalt hillock, about half a mile south of Black Mountain railway station." (Original description.)

The above locality is in the higher parts of New England, New South Wales. The railway station in question is 4,330 feet above sea-level, and between Armidale and Glen Innes. It is 380 miles north of Sydney.

"In 1903 I received from Mr. R. H. Cambage ' a form of *E. eugenioides* Sieb.' from between Tingha and Guyra, and in the following year visited the tree. I labelled it on 1st April, 1905, and again on 30th March, 1906, ' probably a *eugenioides-stellulata* hybrid,' and I put it with my collection of reputed hybrids to be dealt with collectively in my ' Critical Revision.'

"During the present year, Mr. R. T. Baker has described it as a new species (*E. Laseroni*), and says it bears the local reputation of being a cross between *E. lævopinea* and *stellulata*." (*Journ. Roy. Soc. N.S.W.*, xlvii, 229, 1913.)

I wrote as follows in Part VIII, p. 237, of the present work concerning the above and other specimens :—

Near cemetery, Tingha (R. H. Cambage); with fruits a little more sub-cylindrical and perhaps a little more domed than the type. Specimens from the same locality with nearly pilular fruits and very narrow juvenile foliage.

Near 11-mile post, Inverell to Tingha (R. H. Cambage). Form with even narrower leaves than the type (of *E. eugenioides*).

Tingha to Guyra, 19 miles from the latter place (J.H.M. and J. L. Boorman). Juvenile leaves intermediate. Mature leaves broadish. Fruits (from same tree) flat-rimmed, domed; valves exsert and sunk; hemispherical and inclined to be sub-cylindrical.

I place this specimen under *E. eugenioides*, and it certainly seems to form a connecting link between the Tingha specimens and the supposed hybrid which follows.

Between Tingha and Guyra, 19 miles from the latter (J. L. Boorman). "Stringybark," medium-sized trees growing in swampy ground in company with that of *E. stellulata* and *E. nova-anglica*. An interesting form; leaves broad, thickish. None of the fruits with exserted valves, which is unusual in northern specimens. I am of opinion that here we have a hybrid between *E. eugenioides* and *E. stellulata*.

I abstained from describing them as a new species, as I attributed them to a form of *E. eugenioides* or to a hybrid of the same. I concur, however, in Mr. Baker's action in describing them as a new species.

This material extends the range somewhat. The railway station of Guyra is 386 miles north of Sydney, and Tingha runs north-westerly. I have no doubt that the species will be found over a moderately wide area in these cold mountain districts.

Tree of 50 feet, evidently a Black Sally, but the fruits are smaller. Summit of Ben Lomond (William Dunn, 1908, No. 336). Ben Lomond railway station is 401 miles north of Sydney, and the summit of the mountain, only a few miles from the railway station, is over 5,000 feet high. This extends the range northerly, bringing it to a few miles south of Glen Innes.

AFFINITIES.

1. With *E. stellulata* Sieb.

"The small stellate clusters of buds are larger than those of *E. stellulata*, but the colour of the upper branches, though fainter, is also suggestive of that species. The leaves are more inclined to lanceolate than ovate in shape, as obtains in *E. stellulata*, whilst the venation is distinct. The midrib is stronger, and the venation not so parallel as in *E. stellulata*. The bark, timber, and especially the fruits are also different. . . .

The oil of this species differs considerably from that of *E. stellulata*, in the presence of such a large amount of pinene, in a deficiency in phellandrene, and consequently a much less lævo-rotation, in the large amount of high boiling constituents, and in an increased ester-content. . . .

One or two trees were noticed in another locality, associated with *E. stellulata*, from which it is easily distinguished in the field. . . .

In a botanical sequence, it might be placed between the Stringybarks and the Gums or Smooth-barks, such as *E. stellulata* or *E. coriacea*." (Original description.)

I have stated my former opinion that it is a *stellulata* hybrid. There is no doubt that the two species are very closely related. For *E. stellulata* see Plate 25, Part V.

2. With *E. coriacea* A. Cunn.

" The venation somewhat resembles that of *E. coriacea*, but the fruits are different, and especially the buds and bark." (Original description.)

E. coriacea has a close affinity to *E. stellulata*, so that *E. Laseroni* has affinity to *E. coriacea*, but far less than to *E. stellulata*. For *E. coriacea* see Plates 26 and 27, Part V.

3. With *E. capitellata* Sm.

" The fruits fairly well match those of *E. capitellata*, but this is the only resemblance to that species amongst Stringybarks." (Original description.)

The Stringybark in question is *E. eugenioides* rather than *E. capitellata*, as will be seen from examination of fig. 17, Plate 40, Part VIII.

4. With *E. eugenioides* Sieb.

I have already stated that I looked upon *E. Laseroni* as a *stellulata* x *eugenioides*, which is an expression of opinion that an affinity is to *E. eugenioides*. The resemblance between *E. oblonga* DC., see fig. 6 (for Sieber's Fl. Nov. Holl. No. 583, the type), and fig. 7, Plate 40, Part VIII, " White Stringybark " of the Mudgee district, and *E. Laseroni* is obvious, and most people look upon *E. oblonga* as synonymous with *E. eugenioides*.

5. With *E. dives* Schauer.

" The venation (of *E. Laseroni*) seems to be intermediate between that of the typical Stringybarks and the Peppermint group, but more approaching that of *E. dives*." (Original description.)

DESCRIPTION.

CCLXVI. E. De Beuzevillei Maiden.

In *Journ. Roy. Soc. N.S.W.*, liv, 68 (1920).

Following is the original description :—

Arbor ampla plusve minusve glauca; cortice læve, lamellis longissimis decidua, trunci basi aspero-lamellosa, ligno pallido fere albo, gummi venis; foliis fragrantibus, foliis junioribus orbicularibus ad cordatis, venis secondariis patentibus vel sursum curvatis; foliis maturis lanceolatis, crassis, venis secondariis basi patentibus postquam longitudinalibus; alabastris angularibus fere alatis, operculo conoideo calycis tubo ca. dimidio aequilongo; fructibus polygonalibus, angularibus, piriformibus vel subglobosis, capsula depressa, sessile vel brevissime pedunculata.

A tree of medium or large size, up to 60 feet high, a " White Gum," more or less glaucous, the young branchlets glandular. Bark smooth, but with usually more or less rough-flaky bark at the butt. Where the rough bark is present it usually ascends the trunk about 5 to 6 feet; the deciduous or smooth portion in long strips, not ribbons, some of the pieces being 30 feet long. Timber pale-coloured, almost white, with gum (kino) veins, with a general resemblance to that of *E. coriacea.* Foliage fragrant.

Juvenile leaves almost orbicular to cordate, thin, shortly petiolate, secondary veins spreading or curved upwards, no distinct intramarginal vein. Some leaves measured are 9 cm. long by 7 cm. broad.

Mature leaves lanceolate, slightly falcate, with a short blunt point, thick, slightly shining, the secondary veins spreading at the base, thence longitudinal and parallel to the midrib. An average leaf is about 13 cm. long and about 4 cm. in greatest width. There are leaves intermediate in shape, thickness and venation between the juvenile and mature leaves.

Buds remarkably angular by compression, the angles almost winged, peduncles about 1 cm. long, convex to flattened, expanded, especially at the top, pedicels absent or very short, the conoid operculum about half the length of the calyx-tube. Filaments cream-coloured, anthers renantherous.

Fruits polygonal and most of them angled, the angles or ribs persisting until maturity, pear-shaped to sub-globose, sessile or very shortly stalked, walls thick; capsule sunk, 3 or 4-celled.

Type from Jounama Peaks, New South Wales, Wilfrid Alexander Watt de Beuzeville, Assistant Forester, Forestry Commission, December, 1919.

RANGE.

So far it has only been found on peaks in the Mount Kosciusko district of New South Wales. " Near the summit of Mount Jounama, at an altitude of 5,400 feet almost. Jounama is one of what is known as the Bogong Peaks, in the parish of Jounama, county of Buccleuch, about 30 miles south of Tumut. There is a belt of

these trees about 5 or 6 miles long by about half a mile wide, along the top of the Jounama Peaks. Its lowest level would be between 4,500 and 5,000 feet. The tree is one of the largest in the district. The buds mature in a few weeks, and the fruits set immediately; in other words, it flowers and fruits in the same year." (de Beuzeville.) (A consequence of the severity of the climate during the greater part of the year.) This species and *E. stellulata* Sieb. in the same district carry buds and fruits in all stages of maturity during the year.

AFFINITIES.

1. With *E. coriacea* A. Cunn., var. *alpina*.

It differs in being a much larger, and, as a rule, a freer growing plant. "Have never seen a form like it before. Tree much like the ordinary *E. coriacea*, except for it being much more spreading and gnarled, though this might be accounted for by its exposed position at a high altitude." (de Beuzeville.) It has large, mostly oblique leaves and large angular buds. The fruits are also two or three times as large as those of var. *alpina*, and usually with two or three faint angles and a more convex rim.

Its affinity with the Tasmanian *E. coccifera* Hook. f., is more remote.

2. With *E. gigantea* Hook. f.

The affinity lies in the shape of the juvenile leaves (suckers) and more distantly in the fruits. The foliage of both species is fragrant, with the same kind of odour, but *E. gigantea* is a rough-barked species, while *E. de Beuzevillei* is a Gum.

3. With *E. tetragona* F.v.M.

There is similarity in the polygonal, often quadrangular fruits, which requires a word of caution in case fruits are the only material available.

DESCRIPTION.

CCLXVII. E. Mitchelli Cambage.

In *Journ. Roy. Soc. N.S.W.*, lii, 457 (1918), with Plates XXXVIII and XXXIX.

FOLLOWING is the original description :—

Arbor umbrosa in altum pedes quinquaginta crescens, trunci diametrum duorum pedum habens.

Folia matura.—Linearia lanceolata, a septem ad quatuor decim cm. longa, a septem mm. ad 1·4 cm. lata, cum apice directo vel falcato, utrobique aequaliter viridia, glabrosa et notabile nitida, aliquanto coriacea, costa media modice clara, venae laterales aliquanto obscurae et angulis 7–15° e costa media dispositae, margines quasi nervi sunt, olei glandulae numerosissimae petiolum 1–1·3 cm. longum.

Gemmae.—Sessiles, operculum acutum, longae circiter a tria ad quatuor mm. gemmae vix tam longae quam calycistubus, racemus stellatus, pedunculum longum circiter unum mm.

Flores.—In umbella tenus undecim antherae parvae, color ut lactis flos, versatiles, renantherosi.

Fructus.—Sessiles, globosi-truncati, fusci, nitidi quasi fuscati, interdum punctis parvis palladis clavati, longi a quinque ad sex mm. diametrum quinque sexve mm. habentes apud os restricti, labrum interius unum mm. crassus valve depressae.

Cortex.—Levis et alba nisi quod squamus paucas asperes apud basem habet.

Habitat.—Summum jugum montis " Buffalo " prope casam ad provinciam " Victoria " pertinentem, in formationem siliceam graniteam quatuor millia et quadringenti pedes super mare nascens.

An umbrageous tree reaching 50 feet high, with stem diameter of 2 feet.

Seedlings.—*Hypocotyl* erect, terete, red, glabrous, up to 2·3 cm. long.

Cotyledons obtusely quadrilateral to orbicular-reniform, entire, about 3 mm. long, 5 mm. broad, upper side green, under side red to reddish-green, glabrous; petiole about 3 mm. long.

Seedling foliage opposite, entire, glabrous, oblong-lanceolate to elliptical-lanceolate, petiole 1–2 mm. long; midrib prominent on underside, lateral veins fairly distinct, and arranged at angles of from 40–60 degrees with the midrib. On seedlings 5 inches high the second pair of leaves were elliptical-lanceolate, and up to 2 cm. long by 8 mm. broad, while the sixth pair were elliptical, and 2·5 cm. long by 1 cm. broad.

Mature leaves linear-lanceolate, from about 7–14 cm. long, 7 mm. to 1·4 cm. broad, with straight or hooked point, equally green on both sides, glabrous and remarkably shiny, somewhat coriaceous, midrib fairly distinct, lateral veins rather obscure, and arranged at angles of from seven to fifteen degrees with the midrib, margins nerve-like, oil glands very numerous, petiole 1–1·3 cm. long.

Buds sessile, operculum pointed, about 3–4 mm. long, scarcely as long as the calyx-tube, the cluster stellate, peduncle about 1 mm. long.

Flowers up to eleven in the umbel. Anthers small, creamy-white, versatile, renantherous.

Fruits sessile, globular-truncate, brown, shining as if varnished, sometimes studded with small pale dots, 5–6 mm. long, 5–6 mm. in diameter, restricted at the orifice, inner rim 1 mm. thick, valves sunk.

Bark smooth and white except for a few rough flakes at the base.

This species is named in honour of the late Sir Thomas Livingstone Mitchell, Surveyor-General, who collected many native plants, and was the second explorer to pass Mount Buffalo.

RANGE.

Summit of Mount Buffalo, Victoria, near the Government Chalet, growing in siliceous granite formation at 4,400 feet above sea-level, and known as Willow Gum. The species flowers in December.

So far as we know, it is confined to Victoria, but it is hardly reasonable to suppose that it will not be found on the adjacent high mountains (*e.g.*, Mount Kosciusko) in New South Wales, and also in other elevated situations in Victoria.

AFFINITIES.

1. With *E. vitrea* R. T. Baker.

From this it differs somewhat in its leaf venation, for the prominent, almost parallel veins of *E. vitrea* are not represented in this new species. The pedicellate hemispherical fruits of *E. vitrea* are also different; the operculum of that species is shorter and more obtuse, while the peduncle is very much larger. The bark of the new species is smooth and white, that of *E. vitrea* being fibrous over the greater part of the trunk.

2. With ***E. nitida*** Hook. f.

From this it differs in its more globular fruits, pointed instead of obtuse buds, and is an umbrageous tree, while *E. nitida* is only a tall shrubby plant.

3. With ***E. stellulata*** Sieb.

It resembles this species in its stellate buds and to some extent in the shape of its fruits, but differs in its leaf venation, colour of bark which is white, while that of *E. stellulata* is slate-coloured, and in its seedling foliage.

4. With ***E. Moorei*** Maiden and Cambage.

Its resemblances and differences are similar to those mentioned in the case of *E. stellulata*, and in addition *E. Moorei* only grows as a Mallee-like shrub of about 10–12 feet high.

DESCRIPTION.

CCLXVIII. E. Brownii Maiden and Cambage.

In *Journ. Roy. Soc. N.S.W.*, xlvii, 215 (1913).

FOLLOWING is the original description :—

Box tree mediocris, circiter 40′ alta, erecta magis quam dependens. Cortex dura, lamellosa. Folia juvenilia lanceolata vel angusto lanceolata. Folia matura lanceolata, 10–15 cm. longa, 2–3 cm. lata, venis lateralibus angulo 30° ad costam mediam.

Alabastri parvi, clavati, operculum hæmisphæricum, umbella quaque 3–9 in capite. Fructus parvi, conoidei, circiter 3 cm. diametro.

We propose the name in honour of the great Robert Brown, who (amongst other parts) is closely identified with the botany of Northern Queensland.

A medium-sized Box-tree, about 40 feet high, erect rather than drooping.

Bark.—Hard thin flaky Box-bark, on the trunk and large branches, the ultimate branchlets smooth.

Juvenile leaves.—Lanceolate or narrow lanceolate. Generally long and narrow, petiolate, equally green on both sides, and slightly shiny, venation distinct, spreading, intramarginal vein distinct from the edge. Size say 20 by 2 cm.

Mature leaves.—Lanceolate; except as regards the size, the description of the juvenile leaves applies. Size say 10–15 by 2–3 cm. Lateral veins arranged at angle of about thirty degrees with the midrib.

Buds small, clavate, operculum hemispherical or slightly umbonate, and about half the length of the calyx-tube, which tapers gradually into the pedicel.

Flowers.—Inflorescence paniculate, the individual umbels three to nine in the head.

Anthers semi-terminal, nearly globular in shape, opening in small pores on each side near the top. Filament at the base, small gland on the top.

Fruits.—Fruits small, conoid, about 3 cm. in diameter and the calyx-tube about the same length, tapering, not perfectly gradually, into the pedicel, rim thin, tips of the valves flush with the orifice, which is not constricted.

RANGE.

It is confined to Northern Queensland, so far as we know at present.

Type from Reid River, near Townsville (N. Daley, Sept. and Dec., 1912).

Wirra Wirra, Almaden to Forsayth, North Queensland, growing on a somewhat sandy-conglomerate formation which furnishes a more siliceous soil than that usually selected by Box trees. (R. H. Cambage, No. 3895, August, 1913.)

" After the 115th mile-post was passed, an undescribed species of Eucalyptus appeared (*E. Brownii* Maiden and Cambage, these Proceedings, 1913, p. 215). The note made in the train conveys a general description of the tree, and reads :—' A narrow-leaved Box, seems distinct species, rough bark on branches, green leaves.' These trees were growing on a contorted, micaceous slate formation showing quartz, but they continued intermittently to Wirra Wirra, where the rock is sandstone, possibly Upper Cretaceous. This Box tree averages about 40 feet high, with small fruits, and according to Mr. Thomas Keller, of Wirra Wirra, has dark-red timber." (R. H. Cambage in *Journ. Roy. Soc. N.S.W.*, xlix, 413, 1915.)

SYNONYMS.

E. bicolor A. Cunn., var. *parviflora* F.v.M., Burdekin River (see B.Fl. iii, 215),
E. populifolia F.v.M., non Hook.

Scrub Box tree of the Burdekin River, but not the Box tree of the Suttor River, labelled as above, which is *E. populifolia* Hook. All the above specimens were examined by Mueller, and apparently by Bentham also.

AFFINITIES.

Its closest relations are with two species—*E. populifolia* Hook., and *E. bicolor* A. Cunn. Both are indicated by the labels of both Bentham and Mueller.

1. With *E. populifolia* Hook.

To the typical form of *E. populifolia* the resemblance is not close, but there is a narrow-leaved form of the species to which the resemblance is closer. The differences lie in the bark, which is less flaky in *populifolia*, in the more conical fruits of *E. Brownii*, and particularly in regard to the position of the intramarginal vein, which is much more removed from the leaf edge in *E. Brownii*.

2. With *E. bicolor* A. Cunn.

The differences appear to be the duller colour of the foliage of *E. bicolor*, that of the new species being a vivid green, its less spreading venation and less conoid fruits. *E. Brownii* has not the weeping habit of *E. bicolor*.

There is a specimen in the Melbourne Herbarium labelled " near Mount Elliott, Queensland, Fitzalan and Dallachy," which appears to be *E. Brownii*. The late J. G. Luehmann has a note " Placed by Bentham with *E. largiflorens* (*bicolor*), seemingly with injustice. F. v. Mueller."

DESCRIPTION.

CCLXIX. E. Cambageana Maiden.

In *Journ. Roy. Soc. N.S.W.*, xlvii, 91 (1913).

Arbor alta Blackbutt vocata, ramis longis pendulisque. Trunci, cortice cinerea et squamosa altitudini 3–4 pedes, a caule læve et albo ramisque distincte disjuncta. Lignum rubrum. Folia juvenia 15 cm. longa, 2·5 cm. lata, pallido-virentia utrinque, concoloria, ovata vel pyriforma, vena peripherica patente et a margine distincte remota. Umbellæ 3–8 in capite, paniculas plerumque terminales formantes. Alabastri clavati. Operculum ovoideum et calycis tubo circiter dimidio superante. Fructus parvi, conoidei, diametro circiter 7 mm. orificio.

"The young trees grow tall and fairly straight, but with age they become pipy and eventually simply a shell. Very liable to be attacked by white ants." (Miss Zara Clark.)

"The trees range from 50–80 feet high, having long pendulous branches.

"They have scaly bark permanent up to 3–4 feet from the ground; this is hard and of an ironbark nature, jet black in colour, the remainder of the stem being milky-white, approaching bluish-white (glaucous); it is clear of any sign of ribbony bark beyond the butt. There is a distinct line of demarcation between the rough black and the white clean stem.

"The sapwood is exceptionally thin, the heart wood deep red or chocolate in colour, hard, heavy, long and tough in the grain, much resembling that of the Red Box (*polyanthemos*) of New South Wales.

"It is the most important timber in the Emerald district for all purposes, being sound, and yielding long, clean stems of many feet in length, hence exceptionally suitable for milling purposes." (J. L. Boorman.)

Local name, "Blackbutt." Type from Mirtna Station, Charters Towers, Queensland (Miss Zara Clark, January and December, 1912.)

Juvenile leaves.—Pale-coloured, equally green on both sides, rhomboid-ovate to pyriform and broadly lanceolate, petiolate, apex blunt, venation prominent, marginal vein at a considerable distance from the edge, the lateral veins spreading. Oil dots not obvious. Average size say 9 to 12 cm. by 5 or 6 broad.

Mature leaves. Lanceolate, slightly curved, petiolate, thickish, shiny, pale-coloured, equally green on both sides, venation prominent, the intramarginal vein distinctly removed from the edge, the lateral veins spreading. Average length of mature leaves 15 by 2·5 cm.

Flowers. Umbels 3 to 8 in the head, forming usually terminal panicles, buds clavate, the calyx-tube forming a defined raised border at its junction with the operculum, the calyx-tube tapering gradually into the pedicel, the operculum ovoid and about half the length of the calyx-tube.

Anthers belonging to the Porantheræ, pores small, opening at the side, the filament always at the base, and the small gland always at the top.

Fruits.—Small, conoid, the calyx-tube tapering with but slight abruptness into the pedicel; when young, with a well-defined grooved rim, which almost disappears on ripening, leaving a dark brown rim, tips of the valves sunk or rarely flush with the orifice. Size about 7 mm. diameter at the orifice and length the same.

RANGE.

" Grows on hard clay soil, often stony, and always some distance from water. Generally in clumps and often in company of Gidgee and Brigalow in the Charters Towers district." (Miss Zara Clark.)

Reid River, a few miles south of Townsville (N. Daley).

" The principal timber of the Emerald district, noted for its hardness and size, and for the good quality of its timber. Apparently local from Gin Gin to within 10–12 miles east of Alpha." (J. L. Boorman.)

Some poor fruits collected by O'Shanesy from the Dawson and Mackenzie Rivers, labelled *E. leptophleba* by Mueller, are the present species. These were referred to by me in the present work, X, 333, where I doubted the naming of the specimen. It might be neglected altogether but for the reason that (*op. cit.*, p. 333), it evidently formed the basis of the name *E. leptophleba* attached by O'Shanesy to a Blackbutt whose timber and bark he describes. He says " dispersed through the scrubby country westward from Goganjo."

" *E. Cambageana*, the Blackbutt of the Comet River and Coowarra districts, was first noticed between Jericho and Beta, thence onwards at intervals to Gogango, often growing with *Acacia harpophylla* (Brigalow)." (R. H. Cambage in *Journ. Roy. Soc. N.S.W.*, xlix, 445, 1915.)

It is therefore widely diffused in the warmer parts of Queensland, but we do not know its precise range yet.

AFFINITY.

It would appear to take the place, in Queensland, of the more southern *E. polyanthemos* Schauer, or rather of its narrow-leaved forms. The anthers, however, sharply separate them. The leaves also are different both in shape and venation. The rough bark is more scaly than that of *E. polyanthemos*, and the line of demarcation more clearly defined.

It is named in honour of Mr. Richard Hind Cambage, who has done valuable work in connection with this genus. I shall refer to this work more in detail in the epilogue. *E. Cambagei* Deane and Maiden is conspecific with *E. elæophora* F.v.M.

CXXIII. E. miniata A. Cunn.

See Part XXII, p. 37, of the present work, where juvenile leaves collected by Mr. R. H. Cambage at Croydon, North Queensland, were described but not figured.

Juvenile leaves collected by Gerald F. Hill at Stapleton, south of Darwin, Northern Territory, are now figured. Following are some additional notes in regard to specimens collected by Mr. Hill:—

"809. 8-mile Spring, on to Tanumbirini, 26th March, 1912. Occurs near creeks and springs. Stem like Bloodwood.

"552. Top Spring. On Sandstone Range. This specimen, with one loose flower only, is probably this species.

"Pine Creek Railway, Brock's Creek (E. J. Dunn).

"'Woolly Butt.' 'I find that *E. miniata* grows on the deeper loams, while *E. phœnicea* takes its place on the more barren dry parts.' On granite country between Cullen River and Wandi. (Dr. Jensen.)

"Juvenile leaves of this species collected by Mr. R. H. Cambage at Croydon, North Queensland, with abundant stellate hairs, have been already described in *Crit. Rev. Eucal.* iii, 37.

"I have already figured juvenile leaves of this species at fig. 3*a*, Plate 95 of my *Critical Revision*, but Mr. Hill's specimens (below) are more satisfactory.

"I have received juvenile leaves, some in a strictly opposed state, from Darwin, collected in July, 1916. (G. F. Hill.) They vary from oval and ovate to nearly circular.

"Sometimes they are slightly emarginate, with a not very prominent mucro. A not uncommon size is 9 cm. (about $3\frac{3}{4}$ inches) long by up to 7·5 cm. (3 inches), with a petiole 1 cm. long.

"As a general rule the intramarginal vein is not far removed from the edge, but there is some variation in this respect." (Maiden in Ewart and Davies' "Flora of the Northern Territory," p. 312, 1917.)

"*E. miniata* was observed at various points between Almaden and Normanton on siliceous soils, and is usually known as Woollybutt, although that name is also given to *E. clavigera*. It is sometimes spoken of as "Tobacco Pipe Gum," from the resemblance of the large ribbed fruits to the bowl of a pipe, and is the "Melaleuca Gum" of Leichhardt. The lower portion of the trunk is covered with a remarkable yellow, scaly to papery bark, and the branches are smooth (Plate LIX, C.R.)." (R. H. Cambage in *Journ. Roy. Soc. N.S.W.*, xlix, 425, 1915.)

"A tree of 50–100 feet high, trunk to 40 feet, diameter to 3 feet; bark greyish to reddish, woolly-fibrous, rough and persistent on the lower half of the trunk sometimes covering the whole of it; limbs always white and smooth; timber red, very rough, hard; flowers at a height of 2 feet; an inhabitant of poor sandy soil." (Fitzgerald MSS.) The above notes refer to the tree as it occurs in north West Australia. (Quoted by Maiden in *Journ. Roy. Soc. N.S.W.*, li, 454, 1917.)

"*E. miniata* is very abundant between the Gilbert and Little Rivers towards Croydon, North Queensland." (Dr. H. I. Jensen, in a letter to me, June, 1920.)

DESCRIPTION.

E. Woollsiana R. T. Baker.

In *Proc. Linn. Soc. N.S.W.*, xxv, 684, 1900, with Plate XLIII. (No serial number is given, as I do not admit *E. Woollsiana* as a valid species, but a synonym of *E. odorata* Behr and Schlecht., at least in part.)

Following is the original description :—

A large tree up to 80 feet high, and more than 3 feet in diameter. Bark persistent half-way or more than half-way up the trunk; smooth, chiefly of a rich brown colour.

Sucker leaves lanceolate, alternate; 2–3 inches long, ½–¾ inch broad. Mature leaves under 6 inches long, on a petiole less than ½ inch; narrow-lanceolate, tapering to a fine recurved point, mostly of a thin texture, of a light yellowish-green, sometimes slightly shining; venation obscured, impressed on the upper surface; lateral veins few, intramarginal vein removed from the edge.

Peduncles axillary, from 2–12 lines long. *Flowers* few. Calyx about 1 line in diameter, tapering into a short stalk. Operculum hemispherical, acuminate, and often shorter and *more obtuse than shown in the plate.* Ovary flat-topped. Stamens all fertile; anthers parallel; connective large and long, attached at base to the filaments.

Fruits small, 1 line in diameter, hemispherical to slightly pear-shaped; rim thin, slightly contracted, valves not exserted.

Timber.—Hard, close-grained, interlocked, heavy, durable timber of a brownish colour. Useful for bridge-decking, posts, railway sleepers, and general building purposes. It is in great request at the Cobar mines for shoring the roofs.

Let us endeavour to interpret Mr. Baker's views of his species based on his own descriptions and figures.

Illustrations.—Mr. Baker figures *E. Woollsiana* at Plate XLIII, *Proc. Linn. Soc. N.S.W.*, vol. xxv, but gives no particulars as to locality of the specimen.

He figures the species in his and Mr. Smith's "Research on the Eucalypts," and at Nos. 6 and 7 he adds *very broad* leaves to the details of his former plate.

In *Journ. Roy. Soc. S.A.*, xl, 472, he states that Plate 29 (*E. odorata*) of J. E. Brown's "Forest Flora of South Australia" is *E. Woollsiana.* The illustrations are referred to with further detail in the descriptions of the illustrations at p. 223 of the present Part.

Let us consider the characters of *E. Woollsiana*, as stated by Mr. Baker, *seriatim.*

Habit.—"Large tree up to 80 feet high, and more than 3 feet in diameter." (Original description.)

Bark.—" Bark persistent half-way, or more than half-way, up the trunk; smooth, chiefly of a rich brown colour." (Original description.) A specimen from Nyngan, W. Baeuerlen, given to me by Mr. Baker and labelled by him Mallee Box, *E. Woollsiana*, has bark whitish on the outside, thin, flaky, or with narrow furrows, Box-like (like *E. odorata*).

Timber.—" Hard, close-grained, interlocked, of a brownish colour." (Original description.) I have received a specimen of a dark brown timber, bark rough, from Girilambone to Condobolin (W. Baeuerlen), sent by Mr. Baker as a specimen of the type.

Juvenile leaves.—" Lanceolate, alternate, 2–3 inches long, $\frac{1}{2}$–$\frac{3}{4}$ inch broad." (Original description.) These were not figured when the type was figured, but are obviously those shown in Research plate, fig. 1. These can be matched by leaves of *E. odorata*, *e.g.*, 16*b*, 16*c*, 19*a*, Plate 51, Part XI. They are less like those of *E. bicolor*, see fig. 5*a*, Plate 49, Part XI.

The introduction of the broad leaves (figs. 6 and 7, Research plate) introduces a new element. From the distance of the intramarginal vein to the edge, they are evidently juvenile or intermediate leaves. They are matched by the juvenile foliage of *E. odorata*, Wirrabarra Forest Reserve, South Australia (W. Gill, March, 1905), figured in 10*b*, Plate 51, Part XI, but there are larger leaves on the twigs.

Mature leaves.—" Under 6 inches long, on a petiole less than $\frac{1}{2}$ inch, narrow lanceolate, tapering to a fine recurved point, mostly of a thin texture, of a light yellowish green; sometimes slightly shining; venation obscured, impressed on the upper surface; lateral veins few, intramarginal vein removed from the edge." (Original description.)

What Mr. Baker intended by mature leaves is quite clear from fig. 1 (type plate), and also figures 2 and 3 (both type plate and Research, &c., plate). In fig. 5 (Research plate), he added a much longer, more petiolate leaf, which seems to me probably not different from 1–3. There is no difficulty in matching these with *E. odorata*.

Buds.—" Operculum hemispherical, acuminate, and often shorter and more obtuse than shown in the plate." (Original description.) These buds, drawn too pointed, as stated, are figured at fig. 2 of the type plate, and fig. 2 of the Research plate. They are shown six in the head.

As shown in the figures, they a good deal resemble those of pointed buds of *E. bicolor*, see fig. 11*a*, Plate 49, Part XI. But I think the pointed buds are probably a mistake for *E. Woollsiana*, as hinted by Mr. Baker in the word " often." I think the typical form of the species really has the " tip-cat " buds of *E. odorata*, as shown in J. E. Brown's figure of that species (fig. 3*a*, Plate 194) attributed by Mr. Baker to his *E. Woollsiana*, and which buds are the type form of *E. odorata*, see fig. 9*b*, Plate 51, Part XI.

Peduncles.—In the figures of the twig (leaves and flowers, not buds) (see fig. 3 of the type plate and fig. 3 of the Research, &c., plate), the peduncles are shown long and the pedicels distinct.

Fruits.—" Small, 1 line in diameter, hemispherical to slightly pear-shaped, rim thin, slightly contracted, valves not exserted." (Original description.) They are

figured in fig. 8, both of the type plate and the Research plate. It will be observed that they were not taken off the same tree as the buds (fig. 2), and the flowers (fig. 3), as they are nearly sessile, while the twigs of buds and flowers are pedicellate.

(Some of the very small fruits attributed to *E. Woollsiana* would probably have got larger, had not the growth been arrested from various causes.)

Under the heading of *E. Woollsiana* R. T. Baker, in *Proc. Roy. Soc. S.A.*, xl, 479 (1916), Mr. Baker writes :—" There appears to have been some confusion in the past between this species and its congeners, for that figured by J. E. Brown, ' Forest Flora of South Australia ' under *E. odorata* is this species. Specimens were received which match the type (? which type) collected in New South Wales."

This is a narrow-leaved species. I show a tracing of the essential parts of the drawing (J. E. Brown's Plate 29) at figures 3*a*, 3*b*. This is, as Brown, then Conservator of South Australian forests, says, the South Australian *E. odorata*, and although Brown was not a botanist he knew this common South Australian species well. Brown's drawing is, in my view also, *E. odorata*, and will be referred to under *E. odorata* at p. 223. In other words, Mr. Baker synonymises his *E. Woollsiana* with *E. odorata*, and I think he is right.

Vernaculars.—" Mallee Box." This was applied by Mr. Baker to his species, and I have known such a name to be applied in more than one district. It shares the name, however, with *E. odorata*. The name means that the tree sometimes is as small as Mallee, and that it has a Box-like bark, but that individual trees may grow quite large, and shoot up above the prevailing dwarfer (Mallee) vegetation. I never knew it to be a true Mallee. This name has been in actual use for this and allied species at Nymagee, Mount Boppy, Yagobie (towards Queensland border), Inglewood (South Queensland).

Vernaculars are often applied in ignorance, or at all events, without uniformity.

" Black Box " is a name less in use for this species, and most of the cases in which I have heard it used have been owing to confusion with *E. odorata*. At the same time, it has been applied to *E. Woollsiana* (so far as it was supposed to be recognised), and Mr. R. H. Cambage explains it as follows in 1900 :—

" The tree which is best known in the western district as White Box is *E. albens* (*E. hemiphloia* var. *albens*), with pale bark and glaucous leaves, but its habitat is under the western fringe of the high mountain spurs running from the Great Dividing Range, avoiding the cold country, and extending westward along slight undulations to the low plain country proper. Here it ceases, but is met and overlapped by *E. Woollsiana*. All along, and near these points of contact, the latter is called Black Box, to distinguish it from *E. albens*. It is also a darker tree, having dark green and slightly glossy leaves. In times of drought sheep will eat the leaves of *E. albens*, especially after they have been cut a day or two, but they object to the leaves of *E. Woollsiana*." (Cambage in *Proc. Linn. Soc. N.S.W.*, xxv, 715, 1900.)

" Narrow-leaved Box." In comparison with such a species as *E. hemiphloia* (vars. both *albens* and *microcarpa*) *E. Woollsiana* is undoubtedly narrow-leaved, but I think most of the references to the narrowness of the leaves really belong to ***E. Pilligaensis,*** **see p. 210.**

RANGE.

It is unfortunate that a single specimen, and no other, has not been fixed as the type. The author of this species sins, in this respect, in very good company, but absence of definiteness of a type leads to the confusion we all desire to avoid.

Mr. Baker quotes the following localities :—Girilambone, Cobar, and Trangie (W. Baeuerlen); Nyngan and Murga (R. H. Cambage). (Original description.) These are all in western New South Wales.

It will be observed that no type locality is mentioned, neither is it stated, in the explanation of Plate XLIII, figuring *E. Woollsiana* (original description) where the specimens figured came from. I have received, in response to my request for types, specimens labelled by Mr. Baker, Condobolin and Girilambone to Condobolin.

AFFINITIES.

Preliminary.—This tree is a half-barked "Box," and allied in bark and timber to *E. populifolia*, *E. albens*, and other cognate Box-trees. [Of all the Box-trees described this species has probably the narrowest leaves]. . . . (These words in the square brackets are omitted from Research, &c., p. 132.)

The leaves have a shining surface, occasionally as pertains to *E. populifolia* F.v.M., or *E. Behriana* F.v.M. (Original description.)

1. With *E. conica* Deane and Maiden.

"It differs from *E. conica* Deane and Maiden, in height, bark, timber, oil and fruits. Although the two species are not easily separated on herbarium material, they are never confounded in the field." (Original description.) References to *E. conica* are omitted from Research, &c., p. 132.

For *E. conica* see Part XIII, with Plate 60, and also p. 64 of Part XLII. See also Plate 219, Part LVIII of my "Forest Flora of New South Wales." *E. conica* has broader juvenile leaves in contradistinction to the usually narrower ones of *E. Woollsiana*; the fruits also are very different in shape and size, while the anthers of the two species are very different.

2. With *E. microtheca* F.v.M.

"It differs from *E. microtheca* in the valves of the fruit not being exserted, in the colour of the wood, and in the bark and chemical constituents." (Original description.)

For *E. microtheca* see Part XI, figs. 16–22, Plate 52. There are no close affinities; the timber of *E. microtheca* is red, and the fruits sharply different.

3. With *E. viridis* R. T. Baker.

"The fruits are small, and somewhat approach in shape those of the Green Mallee, *E. viridis* Baker; but the bark, timber, and chemical constituents of the kino and oil differentiate it from that species." (Original description.) (This passage is omitted from Research, &c., p. 133.)

"By the casual observer, it is sometimes confused with the large form of *E. viridis*, which is also in places called Mallee Box, but with this tree it has no field affinities." (R. H. Cambage in *Proc. Linn. Soc. N.S.W.*, xxv, 714, 1900)

For *E. viridis* (under the name *E. acacioides*), see figs. 9–12, Plate 52, Part XI. As a very general rule, this is a slender, graceful Mallee.

4. With *E. bicolor* A. Cunn. (*E. pendula* A. Cunn., see Part XI).

". . . . from *E. pendula* A. Cunn., in the venation and shape of the leaves, the shape of the fruits and constituents of the oil, and particularly in its timber, and it has a more erect habit than this species." (Original description.)

For *E. bicolor* see Part XI, with figs. 5–13 of Plate 49. I would be inclined to say that *E. bicolor* has a more pendulous habit than those trees which have been described as *E. Woollsiana*; it is a thick, rough-barked, pendulous, narrow-leaved species, while *E. Woollsiana* has a paler and less rugged bark; the colour of the timber of *E. bicolor* is a rich reddish brown.

5. With *E. populifolia* Hook.

"*E. populifolia* has much wider leaves, but the bark of the species is very similar [but is not associated in any other respect with this species]. (These words in square brackets are omitted from Research, &c., p. 133.) Mr. W. Baeuerlen states 'that it is usually associated with *E. populifolia*, the Green Mallee (*E. viridis* Baker), and the Grey Mallee (*E. Morrisii* Baker), on which account it is called "Mallee Box.' I have never seen it in Mallee form, and as a result of my enquiries it appears that it does not grow in that form.'" (Original description.)

For *E. populifolia* see Part X, Plate 48. The two species are very dissimilar, the only approach (distant) being in the infrequent narrow-leaved form of *E. populifolia*, and in the small fruits, which are, however, different in shape.

6. With *E. hemiphloia* F.v.M.

"From *E. hemiphloia* it differs in the nature of its timber, oil, buds, and leaves. . . . Of described species it is most closely allied to *E. hemiphloia* and other 'Boxes' in oil, kino, and botanical characters. (Original description.)

I agree that the closest affinity of certain specimens attributed to *E. Woollsiana* is to *E. hemiphloia* var. *microcarpa*, indeed that they cannot be separated. In this connection compare, for the former, the illustrations referred to at p. 223, with those of *E. hemiphloia* var. *microcarpa* at Plate 50, Part XI, figs. 7–17. In E. *hemiphloia* we have broad suckers and usually, almost invariably, coarser mature foliage; paniculate inflorescence, which often serves to separate it from its congeners; fruits usually larger and more ovoid. At the same time, in E. *hemiphloia*, through arrested growth and other causes, we may have very small fruits. Mr. Cambage was alive to that many years ago, for, in sending me twigs of *E. hemiphloia* var. *microcarpa*, from Mount

McDonald, near Cowra, he sent twigs tied together with fruits varying in size from as small as ever seen in the figures of *E. Woollsiana* to as large as those seen in the variety of *E. hemiphloia*. The little bundle bore the label, "These three twigs are from the same branch."

The differences between *E. Woollsiana* may be ascertained (if possible) by comparison of the figures, figs. 2*b*, 2*c*, Plate 194, of the specimens attributed by Mr. Baker to *E. Woollsiana*, and figs. 7–17, Plate 50, Part XI, of *E. hemiphloia* var. *microcarpa*. In addition, we must take cognisance of material distributed by Mr. Baker as co-types of his *E. Woollsiana*.

Speaking generally, it may be said that they gradually run into each other, and that there are times when it is difficult to separate them on herbarium material, especially if it be incomplete. The leaf characters do not appear to offer sufficient evidence to always discriminate between them, and the buds and fruits are subject to variation, both in shape and size, as already indicated. The suckers appear to be the strongest characters by which they can be separated, but everything depends on what we know as *E. Woollsiana*.

XLIV. E. odorata Behr and Schlecht.

As I have stated that the mixed material described and sent out as *E. Woollsiana* is chiefly *E. odorata*, I refer to Part XI of the present work, and give some supplementary notes on the latter species.

Habit.—A shrub or medium-sized tree; rarely a very large tree. Sometimes Mallee-like, but not a true Mallee.

Bark.—Dark grey, rough, persistent (Mueller).

I see no difference between *odorata* and *Woollsiana* bark, except that I have more specimens of saplings and branches of South Australian *odorata*. These are smooth and ribbony on the branches.

Timber.—Pale-coloured to brown, hard, interlocked.

"*E. odorata* would, if found in New South Wales, certainly be called a Box-tree, as it looks like a stunted form of *E. Woollsiana*, though its wood appears slightly browner. It is plentiful on the hills near Adelaide, and is known as Peppermint." (R. H. Cambage, *Proc. Linn. Soc. N.S.W.*, xxvi, 321, 1901.)

I see no difference between this and *Woollsiana* timber, except that the latter is perhaps a little darker in colour. The different views of Mr. Cambage and myself as regards the comparative colour of the timber of *E. odorata* and *E. Woollsiana* may be explained because of the fewness of the specimens seen, but the probable explanation is that there is no real difference at all.

Juvenile Leaves.—The comparison with those of *E. Woollsiana* seems to have been sufficiently dealt with under *E. Woollsiana*, see p. 200. The same remarks apply also to the mature leaves, the "tip-cat" buds, and the fruits.

The almost linear juvenile leaf shown at fig. 10*a*, Plate 51, is exceptional, though there are connecting forms with the normal. In the opposite direction, the very broad leaf shown at 16*a* seems exceptional, but both specimens came from a source which allows no doubt as to their botanical origin.

RANGE.

For South Australian and Victorian localities, see Part XI, pp. 33 and 34. The New South Wales localities given at p. 35 should be held in suspense, and the following substituted. When *E. odorata* is better understood, many more New South Wales localities will be found.

"Mallee," pale timber, but not mature. Minore (J. L. Boorman, June, 1901).

"From an old stump of tree, 3 feet or more in diameter, base appeared of a 'boxy' nature." Cobar (J. L. Boorman, July, 1903). Figured at Plate 152, Part XLI, "Forest Flora."

Second growth of tree 2–3 feet in diameter. Mount Boppy (J. L. Boorman, August, 1903).

The note on *E. odorata* by myself, in *Journ. Roy. Soc. N.S.W.*, xlix, 329 (1915), probably refers to *E. bicolor* A. Cunn.

Range of E. odorata var., calcicultrix F.v.M.

To the South Australian localities given at Part XI, p. 35, may be added :—

"Water Mallee," because the roots are used to drain water for human consumption in dry areas. Minnipa, Eyre's Peninsula (W. J. Spafford, No. 14). One foot in diameter. Timber and bark like *odorata.*

New South Wales.

The following specimen shows that it occurs in this State, and it should still further be looked for :—

"Tree of about 30 feet, growing in bed of creek in the same way as *E. rostrata* in these inland places." Broken Hill (A. Morris, Nos. 84 and 102).

AFFINITIES.

1. With *E. Woollsiana* R. T. Baker.

I have already, p. 201, stated that I do not think that *E. odorata* can be separated from *E. Woollsiana,* but perhaps the comments already given under Bark, &c., at p. 200 may be found useful.

E. odorata has broadish suckers and pale brown timber, with commonly dull foliage (at all events in New South Wales specimens), and a Cobar specimen (in the same general district as some specimens of *E. Woollsiana*) will be found figured in Plate 152, fig. E, Part XLI, of my "Forest Flora of New South Wales." It shares with *E. Woollsiana* the name of "Mallee Box."

XLIII. E. hemiphloia F.v.M. var. *microcarpa* Maiden.

As, in my view, it is impossible to understand what is attributed to *E. Woollsiana* without comparison with *E. hemiphloia* var., *microcarpa*, I bring it forward under review at this place, with some additional localities. The variety is described at Part XI, p. 18, of the present work.

Illustrations.—Plate 50, figs. 7–17, Part XI of this work.

SYNONYM.

E. Woollsiana R. T. Baker, *partim*. "The Woollsiana No. 2" of J. H. Maiden in *Proc. Linn. Soc. N.S.W.*, xxix, 764 (1904).

RANGE.

This is stated at Part XI, p. 18. The localities there given have been checked and confirmed, and I desire to give the following additional ones :—

New South Wales.

Deniliquin, rare, believed to be "Black Box" (O. Wilshire).

"Black Box," flats near creek, Experiment Farm, Bomen (Dr. H. I. Jensen).

About 50 feet, with grey granulated bark. Extension of Barns' No. 8 Line, East Mirrool (W. D. Campbell, No. 33). Tree of 50 feet, timber pale. At 3,000 feet on Line 3, Parish of Yenda, East Mirrool (W. D. Campbell, No. 56). Grey Box, very common here. Temora to Morangarell (Rev. J. W. Dwyer, No. 137). Tree of 40 feet, Temora to Mirrool (Rev. J. W. Dwyer, No. 197).

"Narrow-leaved Box." Mulyandey State Forest on the new Grenfell road, 16 miles from Forbes (Forest Guard C. O. Love).

West Wyalong (F. W. Wakefield). Temora. The commonest Box about Temora to Wyalong (Rev. J. W. Dwyer). Cootamundra to Temora (Rev. J. W. Dwyer, No. 205). A tall Box. Ardlethan, Temora to Griffith Line (J. L. Boorman).

White or Grey Box, Condobolin (R. H. Cambage).

Wongoni near Dunedoo (Andrew Murphy).

QUEENSLAND.

Inglewood (J. L. Boorman).

AFFINITIES.

The relations of *E. hemiphloia* (including this variety) and other species will be found stated at Part XI, p. 19. Its relations with what is stated to be *E. Woollsiana* will be found discussed at p. 203 of the present Part.

XLII. E. bicolor A. Cunn

In view of the fact that *E. bicolor* (on herbarium specimens) has been confused with *E. odorata*, and that the species is more diffused than was as one time supposed, the following notes may be useful :—

Bark.—The bark is dark coloured, very thick, and even furrowed like an Ironbark when old, though not so hard; flaky-fibrous, sometimes reminiscent of a Stringybark.

Timber.—The timber is red (or rarely reddish brown). The colour is referred to in this work, Part XI, p. 10. It is sometimes one of the most interlocked of timbers.

RANGE.

This is dealt with at Part XI, pp. 9–12, of the present work, fairly comprehensively.

In *Proc. Roy. Soc. N.S.W.*, xlix, 329 (1915), will be found a note from my pen on the occurrence of *E. odorata* in New South Wales, but the timber is there erroneously described as reddish, because the specimens referred to (now to be enumerated) are really *E. bicolor*. They are :—

" Hybrid Box," T.S.R., ½ mile from Girilambone Railway Station (J.H.M. and J. L. Boorman, August, 1910).

" Mallee Box," 4½ miles from Coolabah Railway Station on way to Coolabah Experiment Farm (J.H.M. and J. L. Boorman, August, 1910).

AFFINITIES.

See Part XI, p. 12.

DESCRIPTION.

CCLXX. E. Pilligaensis Maiden.

In *Journ. Roy. Soc. N.S.W.*, liv, 163 (1920).

Following is the original description :—

Arbor mediocris, cortice cana *E. hemiphloiae* simile et in trunco ramisque persistente; ligno brunneo, fibris tortuosis; foliis junioribus lineari-lanceolatis ca 10 cm. longis et 1·25 cm. latis, utrinque obscuris, venis distinctis sed praeter costam non conspicuis, vena peripherica a margine paullo remota, venis patentibus; foliis maturis angusto-lanceolatis ca 10 cm. longis, 2·5 cm. latis, nitentibus vel obscuro-nitentibus utrinque, venis junioribus foliis similibus; alabastris non angularibus, operculo conico, calyce in pedicillum angustato; antheris *E. odoratae* similibus, stigma paullo dilata; fructibus parvis conoideis ad subcylindraceis ca 3 mm. longis in pedicellum paullo longiorem angustatis, pedunculo ca 9 mm.; margine distincta valvis plerumque 4, valde immersis.

A medium-sized tree.

Bark.—Whitish grey like that of *E. hemiphloia*, and persistent as in that species, on the trunk and main branches.

Timber.—Brown coloured and interlocked.

Juvenile leaves.—Linear-lanceolate, say 10 cm. (4 inches) long and say 1·25 cm. ($\frac{1}{4}$ inch) broad, dull on both sides, venation distinct though not conspicuous, except as regards the midrib. Intramarginal vein a little distant from the edge, venation spreading.

Mature leaves.—Narrow lanceolate, say 10 cm. (4 inches) long, and up to say 2·5 cm. ($\frac{1}{2}$ inch) broad, shining or dull-shining (egg-shell lustre) on both sides; venation as in juvenile leaves.

Buds.—Not angular, with conical operculum, the calyx tapering into the pedicel.

Flowers.—Anthers very similar to those of *E. odorata*; the stigma slightly dilated.

Fruits.—Small, conoid to subcylindrical, say 3 mm. ($\frac{1}{8}$ inch) long, tapering to a pedicel rather exceeding that length, into a common peduncle of 9 mm. ($\frac{3}{8}$ inch); rim distinct, valves usually four, well sunk.

This tree has received both attention and neglect, because it has been by some looked upon as included in *E. Woollsiana* R. T. Baker. As I have now no hesitation in saying that it is not included in *E. Woollsiana* (compare Mr. Baker's figures of that species), and as I am of opinion that it has not been formally described as a species, I offer it as new. Inasmuch as it is so common in the Pilliga Scrub, New South Wales, that the district may be looked upon as a focus of it, the specific name chosen may be useful.

Illustrations.—See Part XI, Plate 51, figures 27–30 of the present work; also my "Forest Flora of New South Wales," Part XLI, Plate 152, figures B and C, for much larger and better figures. These were all drawn from a specimen collected by me at Narrabri, New South Wales, in November, 1899, and form the type. A photograph block of saplings at Gilgandra, New South Wales (R. H. Cambage) was backed by specimens referable to this new species. All the figures were labelled *E. odorata* var. *Woollsiana*.

SYNONYM.

E. odorata Behr and Schlecht., var. *Woollsiana* Maiden, as described at p. 32, Part XI of the present work.

RANGE.

So far as I know, this species is confined to New South Wales and Queensland, but we have much to learn in regard to its range in these, and possibly in other States. It is represented by the following specimens in the National Herbarium, Sydney. The localities quoted are all in the northern half of New South Wales, extending just into Queensland, the two quoted from that State marching with the northern New South Wales localities.

New South Wales.

Mount Boppy (J. L. Boorman, August, 1903). Four and a half miles from Coolabah Railway Station on the way to the old Experiment Farm (J. L. Boorman and J.H.M.). "Mallee Box," Moondana, Parish Flinders, Nymagee district (Forest Guard E. F. Rogers).

Gilgandra (R. H. Cambage No. 1135, with photo. of a clump of saplings, already quoted). Large shrub or small tree, Dubbo–Gilgandra road, 18 miles from Dubbo (W. Forsyth, No. 2). "Narrow-leaved Box," Coonamble (E. Taylor).

Castlereagh River (Rev. Dr. Woolls), labelled *E. largiflorens* by Mueller. "Narrow-leaved Box," on the plains near Baradine (W. Forsyth, No. 5).

Very common in the Pilliga Scrub, as the following specimens will show:—

Box, slaty smooth bark on branches. Forest Reserve 1,263, Parish Leard, County Nandewar; 45 feet high, girth 54 inches (Forest Guard M. H. Simon). "Narrow-leaved Box." Bark greyish in colour and rough on trunk, smooth on limbs and of darkish colour. Height 60 feet, diameter 3 to 4 feet. Wee Waa (Forest Guard T. W. Taylor, No. 14). "White Box," near Old Wongan Station, Dubbo Creek area (Dr. H. I. Jensen, No. 56). "Gum-topped White Box." Cuttabri (J. L. Boorman, Dr. H. I. Jensen, Nos. 2, 19). "Narrow-leaved Box." A tree of 60 feet, fairly straight, Parish Kenebri, County White, Pilliga (E. H. F. Swain, No. 40). A Box, girth 7 feet, Pilliga (E. H. F. Swain, No. 29).

Narrabri, November, 1899 (J.H.M.). The narrow suckered tree defined by me as *E. odorata* var. *Woollsiana*. Type of *E. Pilligaensis*.

"A Box growing on flats, black soil plains, by side of river, medium-sized trees." Narrabri West (J. L. Boorman). "Narrow-leaved Box. Bark whitish-grey, like that of *E. hemiphloia*, and persistent as in that species, on the trunk and main branches. I also saw it growing in the Forbes district." Narrabri (Henry Deane). (I have not seen the Forbes specimens—J.H.M.)

"Narrow-leaved Box." Moree (W. S. Campbell). In flower only, and at one time considered by me to be *E. odorata*.

"Apple," Bingara (E. H. F. Swain, No. 11). "Mallee Box," Yagobie, between Gwydir and MacIntyre Rivers (E. H. F. Swain, No. 8).

Dark flaky bark. Denman, the most southerly locality known, at all events in the coastal districts (W. Heron, No. 24).

QUEENSLAND.

A medium-sized tree, known locally as "Mallee Box," Inglewood, *via* Warwick (J. L. Boorman).

"Ribbon Box." Same growth, size, and bark as Gum-topped Box (*E. hemiphloia*), but leaves narrow and fruit very small. Very abundant. Wyaga, Goondiwindi district (C. T. White, No. 26).

AFFINITIES.

It is known as "Narrow-leaved Box," and best deserves this name of all the Boxes. This, combined with the remarkably small fruit, readily separates it from such species. From *E. Woollsiana* R. T. Baker, *E. odorata* Behr and Schlecht., *E. hemiphloia* F.v.M. var. *microcarpa*, *E. conica* Maiden, all Boxes, like it, with pale timbers and similar bark, it is distinguished by its very narrow juvenile leaves and usually narrower mature leaves. From *E. bicolor* A. Cunn., which has narrow juvenile leaves, it is sharply separated by the thick, dark bark and red-brown timber.

DESCRIPTION.

CCLXXI. E. Penrithensis Maiden.

In *Journ. Roy. Soc. N.S.W.*, xlvii, 227 (1913).

FOLLOWING is the original description :—

Arbor mediocris, "Bastard Stringybark" vocata. Cortex trunci dura et subfibrosa. Rami teretes. Folia matura crassiuscula, venis nitentibus, distinctis, patentibus, vena peripherica a margine remota. Alabastri stellulati, juvenes angulatiusculi, maturi clavatiores. Operculum conicum. Flores paniculati 4–10 in umbella quaque. Antherae reniformes. Fructus hemisphærici ad fere pilulares diametro circiter 5 mm. margine lævo et conspicuo. Fructus a pedicello filiforme acute disjuncti.

"Bastard Stringybark" or "Peppermint." Two miles east of Penrith, New South Wales (J. L. Boorman, January, 1900). A tree of medium height and very scarce locally.

Bark hard fibrous on the trunk, branches smooth, intermediate in character between a "Stringybark" and a "Peppermint."

Timber reddish brown and with concentric though not abundant gum-veins.

Intermediate leaves petiolate, falcate, acuminate, mostly unsymmetrical, rather coriaceous, equally green on both sides, venation prominent, spreading, intramarginal vein well removed from the edge. Average size say 13 cm. by 3 cm. broad.

Mature leaves much smaller, say 9 cm. by 1 cm. broad, rather thick, shiny, plentifully besprinkled with black dots, venation the same, resembling those of intermediate leaves.

Buds stellulate and somewhat angled when very young, more clavate as maturity approaches. Operculum conical, the calyx-tube tapering into a short pedicel.

Flowers paniculate, 4 to 10 in the individual umbel, which has a slightly flattened common peduncle under 1 cm. long. Anthers kidney-shaped.

Fruit hemispherical to nearly pilular, diameter about 5 mm. with a well-defined smooth rim, tips of the valves either sunk, or not protruding beyond the orifice. The fruit is sharply separated from the filiform pedicel.

SYNONYM.

E. Marsdeni C. Hall, in *Proc. Linn. Soc. N.S.W.*, xliii, 747 (with a Plate).

I submit drawings of the types of both *E. Penrithensis* and *E. Marsdeni*. The material is not large in either case; the barks are the same; the fruit of *E. Penrithensis* is a little smaller, but I can find no botanical differences between them. Dr. Hall realises that the species is not a strong one, calling it "f. vel sp. nov." He also says: "I have named this form or species tentatively *E. Marsdeni*, after the Rev. Samuel Marsden, the first incumbent of St. John's Church, Parramatta."

Following is the original description of *E. Marsdeni* :—

" Arbor 30–50′ altitudine, cortice fibroso inferne superne lævi foliis petiolatis, lanceolatis, acuminatis, falcatis, obliquis, fere membraneis; cymis axillaribus; pedunculis 4‴ longis, pedicellis 1½‴; operculo hemisphærico, umbonato; fructibus hemisphæricis, valvis parum exsertis."

A tree, 30 feet high in specimen observed, and probably would attain a height of 60–80 feet when fully grown.

Seedling.—Cotyledons very small, orbicular-reniform, entire purplish on under-surface, glabrous. Leaves opposite, decussate, obtuse, shortly petiolate, lanceolate, venation pinnate, rather oblique, edges sinuate. Stem reddish, and both it and the leaves covered with fine, stellate hairs.

Juvenile leaves of a more advanced stage than in the small seedling are alternate, petiolate, narrow-lanceolate, acuminate, glabrous. Mature leaves alternate, petiolate, falcate, acuminate, oblique, greyish on drying, almost membranous, occasionally shiny, and having a pleasant, aromatic scent. Laminæ 6 inch–8 inch long by ¾ inch broad, petiole slender, ½ inch long. Lateral veins oblique, alternately fine, intramarginal vein fairly distant from the edge.

Inflorescence axillary, peduncles ½ inch long, with rather few flowers in head, six to nine; buds turbinate, 5 inches long, operculum hemispherical, shortly acuminate. Stamens all fertile, anthers kidney-shaped. Fruits hemispherical 3 lines in diameter, rim domed, valves small, slightly exserted.

Bark of an unusual character for a Eucalypt. While it falls in the group of the stringybarks, yet it is laminated, with a sort of ochreous deposit on the surface of each layer. Inner bark very hard and compact. But while the trunk and lower branches have such bark, that of the upper branches and branchlets is smooth and greyish, so that the tree is really a half bark.

Timber light brown in colour, fairly heavy, close, straight in the grain, annual rings prominent in the young stage, planes and dresses well, and should be useful for technical purposes; gum-veins few.

RANGE.

Confined to the County of Cumberland, New South Wales, so far as we know at present.

The type of *E. Penrithensis* came from two miles east of Penrith, New South Wales. Guided by Mr. Boorman I saw the tree a month or two afterwards, but it and a few others, believed to be the same, were cut down a short time subsequently, and others could not be traced.

Toongabbie, New South Wales, at the rear of the Public School, on the Wianamatta clay, is the only locality known of the type of *E. Marsdeni*, but I understand from Dr. Hall that his specimen cannot be found now, having probably shared the same fate as the type tree of *E. Penrithensis*.

See also notes at pp. 236 and 237 (under *E. eugenioides*) in Part VII of the present work.

It will probably turn out that *E. Penrithensis* is not as rare as was at once supposed. It has probably been passed over as a ragged, hard Stringybark, and looked upon as an anomalous *E. eugenioides*.

The following two specimens probably belong to this species :—

1. Field of Mars, Gladesville, two trees close together, pointed out by J. J. Fletcher to R. H. Cambage and myself in February, 1905, and Mr. Cambage and I collected specimens, while Mr. Cambage took admirable photographs of the trees, which will be reproduced when Barks in the genus are arrived at.
2. Galston-road, about 1 mile from Hornsby, Mr. Sutton's property (W. F. Blakely, 21st October, 1918).

These two specimens apparently vary only in robustness from the type of *E. Penrithensis*, the Galston specimen being from a young, vigorous tree, which would account for this.

AFFINITIES.

This is an anomalous, rare, and apparently local species, and one naturally looks upon it as a hybrid. At the same time, hybridism is difficult to prove. Of course it is not necessary to prove that the assumed parents are to be found, at the present time, in close juxtaposition to the individuals from which one obtained material in the present case. The parents may be some distance away, and the seed of the trees may have been conveyed in a number of ways. Possibly the parents are *E. eugenioides* Sieb. and *E. hæmastoma* Sm. var. *micrantha* Benth. Let us consider these in detail. (Original description.)

Dr. Hall was also of opinion that his species (*E. Marsdeni*) might be a hybrid, and he and I formed these opinions independently in regard to the practically solitary specimens of *E. Penrithensis* and *E. Marsdeni* referred to. It will be best to give his remarks from the original description *litteratim* :—

" As seen from the description, this form of Eucalypt, on a cortical classification, seems intermediate between the smooth-barks and stringy-barks. The timber has not the texture of that of the stringy-barks, but more nearly resembles that of *E. viminalis* in physical characters. The early buds resemble those of *E. obliqua*, but there is no resemblance in the mature stage. The mature leaves are generally markedly oblique. The fruit resembles that of *E. eugenioides*, but it tapers more into the pedicel, and is not so flat; nor are the fruits so clustered on the peduncle. The seedling is intermediate between those of *E. eugenioides* and *E. Moorei*; and, in its hairy seedling-leaves and reniform cotyledons, approximates strongly to the stringy-barks. The reniform anthers also place it in that category, but the bark, timber, and oil are quite distinct from those of this class. As, so far, only a single tree is known, one is strongly inclined to conclude that it is either a hybrid or a sport. Strong colour is lent to the hybrid theory by the fact of it possessing so many of the characters of the stringy-barks, especially in the seedling stage; yet differing from them in others in the mature stage, as, for instance, in the bark, oil, and timber. Since the only tree has, unfortunately, lately been cut down, further comparison is at present impossible. Now that a description has been published, search may reveal further specimens, and more definitely establish its status. The tree was a young one, about 12–15 years old, and growing on land that had been mostly cleared, but with a few well-grown trees of *E. hæmastoma*, *E. resinifera*, and *E. siderophloia* in proximity. Other trees near by were *E. crebra*, *E. eugenioides*, *E. hemiphloia*, *E. punctata*, and *E. tereticornis*."

1. With *E. hæmastoma* Sm. var. *micrantha* Benth. (A " White Gum.")

The affinities lie in the smoothness of the branches, the fruits, and the young (intermediate) leaves. (Original description of *E. Penrithensis.*)

2. With *E. eugenioides* Sieb. (A " Stringybark.")

The bark indicates some affinity to the Stringybark, and there is also affinity in the foliage (as also with the White Gum). There is some (not close) resemblance in the fruits, while the pedicellate fruit is seen in the White Gum. (Original description of *E. Penrithensis.*)

Some remarks on supposed hybridism in which *E. eugenioides* takes a part, will be found under *E. Laseroni*, p. 187.

3. With *E. piperita* Sm.

Penrith is not in *E. stellulata* country, and the relations of the proposed new species with *E. piperita* may be examined. The barks resemble each other a good deal. The pointedness and curvature of the young buds reminds one of those of *E. piperita.* The resemblance of the foliage and anthers would apply more or less to *E. eugenioides, hæmastoma*, and *piperita.* (Original description of *E. Penrithensis.*)

CXII. E. micranthera F.v.M.

See the present work, Part XX, Plate 88, p. 308.

This excessively rare and imperfectly known Western Australian species has been sent to me (*Journ. Roy. Soc. N.S.W.*, lii, 506) by Mr. H. P. Turnbull, of the Alexander River, about half-way between Esperance and Israelite Bays, on the south coast.

Unfortunately he was unable to recognise the specimen, and so to say the exact spot where he collected it, and thus obtain more material, but he has obtained fruits (unfortunately the seed had all dropped out), and these, being new to science, may be described as follows :—They are hemispherical in shape, and about 7 mm. in diameter, shining, with one moderately prominent angle. The pedicels short and flattened, supported by a flattened peduncle of twice the length. The rim horizontal or slightly rounded, the teeth of the calyx flush with the rim or slightly exceeding it. They are figured at fig. 5*b*, Plate 195.

E. micranthera certainly resembles *E. cneorifolia* DC. in the narrowish leaves and sessile inflorescence. The peduncle of *E. micranthera* is broader and more compressed; the fruits are very similar in both species, but the anthers are smaller in *E. micranthera* and the filaments broader and more yellowish or yellowish-green. The leaves of *E. micranthera* have longer petioles and are somewhat broader.

DESCRIPTION.

CCLXXII. E. notabilis Maiden.

In *Journ. Roy. Soc. N.S.W.*, liv, 169 (1920).

FOLLOWING is the original description :—

Arbor mediocris pulchra umbrosa, cortice lamelloso-fibrosa "Mahogany" simile, ligno pallido rectis fibris duro. Ramulis quadrangulatis. Foliis juvenilibus lanceolatis, petiolatis, pallidis, inferiore pagina, venis secundariis fere parallelibus. Foliis maturis crassis, coriaceis, lanceolatis, rectis vel falcatis, penniveniis. Alabastris ad 9 capitulo, pedunculo lato fere sessile, calycis tubo hemispherico ad hemiellipsoides, angulis duobis prominulis. Fructibus fere hemisphericis, ca 7 mm. diametro angulis vel alis duobus, margine distincta, valvis valde exsertis.

A tree of moderate size, say about 50 feet, with a diameter of 4 to 5 feet. It has rich dark umbrageous foliage, and is a handsome species.

Bark flaky-stringy, or fibrous-flaky in young trees. It is rough to the tips of the branches, and the trunk does not display corrugations of the bark. Timber pale-coloured (of the palest brown when freshly cut), straight grained, a good splitter, and possessing a fair degree of tensile strength.

Juvenile leaves.—Young branchlets markedly quadrangular, leaves very thin, pale on the underside, punctate, lanceolate, petiolate (say 10 or 11 cm. long, 3 or 4 cm. broad, with petioles of 1 cm. and more), secondary veins thin, roughly parallel, rather spreading, making angles of 60–80 degrees with the midrib, a few nearly at right angles; intramarginal vein well removed from the edge.

Mature leaves thick, coriaceous, of egg-shell lustre on the upper, but dull on the lower surface, lanceolate, straight or falcate, tapering into a long apex, petiolate, up to 14 cm. long and more, up to 4 cm. in greatest width, with petioles of 2 cm. Venation inconspicuous, the secondary veins penniveined, nearly as parallel and commonly making scarcely a more acute angle with the midrib than the Corymbosæ; the intramarginal vein not far removed from the edge.

Buds up to nine in the head, on a broad strap-shaped peduncle of 1 cm. or less, sessile or on pedicels of ·5 cm., each commonly with a double operculum; calyx-tube hemispherical to hemiellipsoid, with two angles or ribs sometimes so prominent as to be winged; operculum hemispherical to conoid, up to 7 mm. in diameter and sometimes exceeding that of the calyx tube.

Anthers white, opening in parallel slits, the two cells usually cohering to the tips; versatile; large gland at the back.

Fruits almost hemispherical, about 7 mm. in diameter, often with two or more angles or wings; rim well defined; the calyx valves three or four, broad at the base, and the tips well exsert.

Type.—Glenbrook, Blue Mountains, New South Wales. (R. H. Cambage and J.H.M.)

Illustrations.—The new species is figured as intermediate between *E. resinifera* and *E. pellita* in the present work, Part XXX, Plate 125, figs. 7, 8, 9. We there have a juvenile leaf, mature leaf, buds with hemispherical and conoid opercula, anthers and fruits.

SYNONYM.

Recorded as the Blue Mountains form of those intermediate between *E. pellita* F.v.M. and *E. resinifera* Sm. See present work, Part XXX, pp. 216, 217.

RANGE.

Confined to New South Wales so far as we know at present, and to the vicinity of the lower slopes of the Blue Mountains, but owing to wide-spread confusion with *E. resinifera* we have much to learn of its range. It has only been recorded so far from the Lower Kurrajong and Glenbrook to Faulconbridge.

Following are specific localities :—Lower Kurrajong, one of the lower slopes to the Blue Mountains (J.H.M.) ; Glenbrook (R. H. Cambage, J.H.M., J. L. Boorman); Lapstone Hill to Springwood (R. H. Cambage and J.H.M.); Springwood (J. L. Boorman); North Springwood (R. H. Cambage and J.H.M.); Faulconbridge (J.H.M.).

AFFINITIES.

1. It is one of the few species, of which *E. gomphocephala* DC. is the most notable, which have an operculum of diameter greater than the calyx-tube, giving it an overhanging appearance.

2. The anthers of *E. notabilis* and *E. canaliculata* are to all intents and purposes alike. Affinity to each other is thus indicated, and also that they belong to the same group, which includes *E. punctata*, *E. resinifera*, and *E. pellita*.

3. With *E. resinifera* Sm. (and *E. pellita* F.v.M.).

The position of *E. notabilis* seems to be nearest to these two species, but closer to the former in some respects. The figures and remarks on this association have already been referred to. The bark is that of a " Mahogany," but the paleness of the timber of *E. notabilis* at once separates it from these two species.

DESCRIPTION.

CCLXXIII. E. canaliculata Maiden.

In *Journ. Roy. Soc. N.S.W.*, liv, 171 (1920).

Following is the original description:—

"Grey Gum" alta, in cortice læve maculis lenticularibus. Ligno pallido, fibris crassis, duro. Foliis juvenilibus petiolatis, lanceolatis, venis tenuibus. Foliis maturis, angusto-lanceolatis, paullo crassis, venis tenuibus fere parallelibus angulum ca 45° cum costa formantibus. Alabastris magnis, clavatis, umbellis ad 6 capitulo pedunculis applanatis; operculo hemiellipsoideo, mucrone breve. Fructibus magnis, conoideo-hemisphericis, pedicello breve applanato, calycis tubo duobus costis prominentibus margine paullo rotundata conspicua.

A tall Grey Gum, whose trunk usually averages scarcely 2 feet in diameter, but it may attain, exceptionally, twice that size (A. Rudder). It is a tall tree with a diameter of 4 feet, 70 feet to the lowest branches, the whole tree being 90–120 feet high (J. L. Boorman, also speaking of a Dungog tree). Bark smooth, but with lenticular patches in places, like that of a Grey Gum (*E. punctata*).

Timber pale coloured, somewhat coarse-fibred, interlocked and tough, resembling that of Spotted Gum (*E. maculata*) a good deal, and also that of Tallow-wood (*E. microcorys*). The colour of the timber approximates to pale snuff-brown, say, Dauthenay, Rep. de Couleurs, Plate 2, shade 303.

Juvenile leaves not seen in the earliest state, but some still opposite are lanceolate to broadly-lanceolate, equally green on both sides, with numerous fine, not prominent, roughly parallel veins, at an angle of about 45 degrees with the midrib. Leaves about 5 or 6 cm. long, and about half that width, with petioles of 2 cm.

Mature leaves of medium size, narrow-lanceolate, petiolate, say 1–2 dm. long and 2–3·5 cm. broad with petioles say 2–3 cm. long, dark green, moderately thick venation almost as in juvenile leaves.

Buds large, clavate, umbels up to six in the head on flattened expanding peduncles 2 cm. long and more, the calyx-tubes with one or two opposite sharp ridges, gradually tapering in short but distinct thick pedicels, the operculum hemi-ellipsoid with a short mucrone, each bud with a second deciduous operculum which leaves a sharp commissural edge.

Anthers white, opening in parallel slits, the cells cohering at their edges; versatile, gland at the back.

Fruits large, about 1·7 cm. in greatest width and about the same in depth, including the tips of the capsule. Conoid-hemispherical, the shiny calyx-tube with a short-flattened pedicel, the continuation of the edges of which forms two somewhat sharp ridges. The calyx-tube is surmounted by a slightly-domed conspicuous rim of about 3 mm. in width (which rim morphologically consists of a fusion of the disc and of the staminal ring). This again is surmounted by a pudding-basin rim barely 2 mm. wide. Valves triangular, moderately exsert.

Type.—Seven miles from Dungog on the Booral-road (Augustus Rudder, J. L. Boorman). The specific name is given in reference to the channelled appearance of the fruit.

Illustrations.—See my "Forest Flora of New South Wales," fig. D, Plate 37, Part X (fruits); the same drawing reproduced in the present work, Part XXIX, fig. 1, Plate 123. For mature leaf, buds and anther, see figs. 9*a–c*, Plate 122 of the present

work. The specimens " fruit rather globular, but not perfectly ripe," Spit-road, Manly, Port Jackson (J. L. Boorman), figured at fig. 3, Plate 123, do not belong to *E. punctata* var. *grandiflora* (*E. canaliculata*); they belong to *E. punctata*, though they are rather larger than those of the type.

SYNONYM.

E. punctata DC., var. *grandiflora* Deane and Maiden, in *Proc. Linn. Soc. N.S.W.*, xxvi, 133 (1901).

RANGE.

It seems to be confined to New South Wales. " I have only observed the large-fruited Grey Gum in the counties of Gloucester and Durham. It seems, so far as I have seen, to occupy the intermediate country a little back from the coast to near the eastern slopes of the Dividing Range. I do not think it is very plentiful, but small patches of it are occasionally met with, besides isolated trees, and it often associates more or less with the small-fruited Grey Gum, *E. propinqua*." (The late Augustus Rudder in a letter to the writer, dated 31st August, 1893.)

It grows in company with Ironbark (*E. paniculata*) and abundance of *E. saligna*. It is very scarce in the Dungog district (J. L. Boorman).

AFFINITIES.

1. With *E. saligna* Sm.

The similarity of these trees is chiefly in their barks, but the differences between them in this respect have been already stated. Mr. Boorman says that, at Dungog, the direction of the branches in *E. canaliculata* is more horizontal and the shape less inclined to be pyramidal as in *E. saligna*. The floral organs and the timber, of course, sharply separate them. (See Plates 99 and 100, Part XXIII, of the present work, for *E. saligna*.)

2. With *E. punctata* DC.

The new species is nearer *E. punctata* (indeed, it has been regarded as a variety of it) than *E. saligna*, but the discovery that *E. canaliculata* has a pale timber at once showed that it must be removed from *E. punctata* and other species with red timbers. For drawings of details of *E. punctata* see the present work, Part XXIX, Plates 121 and 122, while that of *E. canaliculata* are in the same Part (as *E. punctata* var. *grandiflora*)

in Plates 122 and 123. The anthers of the two species are alike. The outstanding difference shown there is in the smaller size of the buds and fruits of *E. punctata*, their less tendency to vertical angularity, and less marked commissural edges. The juvenile leaves are broader in *E. punctata*.

3. With *E. maculata* Hook.

We have undoubted affinities in the smooth, more or less blotched bark, and also in the timber, for both are remarkably alike in external characters. But *E. maculata* (Plate 178, Part XLIII) is a well defined member of the Corymbosæ, and the differences are very great, as regards the organs.

Explanation of Plates (192-195).

PLATE 192.

E. Laseroni R. T. Baker.

1*a*. Juvenile leaf; 1*b*, mature leaf; 1*c*, head of buds (fourteen); 1*d*, head of fruits, almost sessile. Black Mountain near Guyra, N.S.W. (C. F. Laseron.) The type.

2. Mature buds and flowers. Summit of Ben Lomond, near Glen Innes, N.S.W. (William Dunn.)

3. Front and back views of anther. 19 miles from Tingha, on the Guyra road, N.S.W. (J. L. Boorman and J.H.M.)

E. de Beuzevillei Maiden.

4*a*. Juvenile leaf; 4*b*, intermediate leaf; 4*c*, mature leaf; 4*d*, buds (note the ribs); 4*e*, front and back views of anther; 4*f*, fruits (note the ribs). Jounama Peaks, County Buccleuch, N.S.W. (W. A. W. de Beuzeville.) The type.

E. Mitchelli Cambage.

5*a*. Buds; 5*b*, anther; 5*c*, pendent fruiting twig. Juvenile leaves not available. Mount Buffalo, Victoria, around the Chalet. (R. H. Cambage.) The type.

PLATE 193.

E. Brownii Maiden and Cambage.

1*a*. Juvenile leaf; 1*b*, mature leaf, the venation scarcely visible; 1*c*, short panicle showing buds and flowers; 1*d*, front and back views of anther; 1*e*, mature fruits (observe the rims). Reid River, *via* Townsville, Queensland. (Nicholas Daley.) The type.

E. Cambageana Maiden.

2*a*. Juvenile leaf; 2*b*, leaf a little further advanced; 2*c*, mature leaf; 2*d*, buds and flowers; 2*e*, front and back views of anther; 2*f*, mature fruits. Mirtna Station, Charters Towers, Northern Queensland. (Miss Zara Clark.) The type.

E. miniata A. Cunn.

3. Juvenile leaves, almost in the opposite stage. They have not previously been figured in this stage. See Part XXII, Plates 95 and 96, where figures of this species are given. The figures on Plate 95 are in the intermediate stage and come nearest to the juvenile leaves at present figured, and which are described at p. 198 of the present Part. Stapleton, near Darwin, Northern Territory. (Gerald F. Hill.)

PLATE 194.

E. Woollsiana R. T. Baker.

The figures on this Plate are taken from three different sources, all certified to by Mr. Baker as *E. Woollsiana*. They are:—

A. *Proc. Linn. Soc. N.S.W.*, xxv, 684, Plate XLIII (1900). This is the type.

(*E. Woollsiana* is mixed material in which *E. odorata* predominates. As this has been discussed at pp. 199 to 201, the facts will not be repeated here.)

Mr. Baker gives no particulars as to the locality of the specimen figured as his type. In Plate 194, 1*a*, is a reproduction of fig. 1 of Mr. Baker's drawing of the type. It is a broadish, mature leaf. 1*b*, mature leaf and pointed buds. Reproduction of fig. 2 of type. (This drawing is modified by the statement at p. 132 of the "Research," "Operculum often more obtuse than shown in the Plate.") 1*c*, twig with mature leaves, flowers, and immature fruit. Reproduction of fig. 3 of type. 1*d*, mature fruits. Reproduction of fig. 8 of type.

B. "Research on the Eucalypts," Baker and Smith (1902).

In the Plate of *E. Woollsiana* in that work Messrs. Baker and Smith added 2*a* (Plate 194), which is a reproduction of fig. 1 of the "Research" Plate; 2*b*, 2*c*, which are broadish intermediate leaves, reproductions of Nos. 6 and 7 of the "Research" Plate.; 2*d*, a very long, narrowish, mature leaf, a reproduction of No. 5 of the "Research" Plate.

C. "Forest Flora of South Australia," J. Ednie Brown, Plate 29. The figure of *E. odorata* in that work is in *Proc. Roy. Soc. S.A.*, xl, 479 (1916), attributed by Mr. Baker to *E. Woollsiana*.

3*a*. Flowering twig; 3*b*, fruits (both reproduced from J. E. Brown's Plate); 4, anther, *E. odorata*. Murray Bridge, South Australia. (R. H. Cambage and J.H.M.)

PLATE 195.

E. Pilligaensis Maiden.

1*a*. Juvenile leaves; 1*b*, mature leaves and immature buds; 1*c*, fruits. Narrabri, N.S.W. (J. H. Maiden.) The type.

2*a*. Twig with almost ripe buds; 2*b*, anther. Bingara, N.S.W. (E. H. F. Swain.)

E. Penrithensis Maiden.

(Of which *E. Marsdeni* C. Hall is a synonym.)

3*a*. Intermediate leaf; 3*b*, mature leaf; 3*c*, buds; 3*d*, front and back views of anther; 3*e*, fruits. Two miles east of Penrith, N.S.W. (J. L. Boorman and J.H.M.) The type of *E. Penrithensis*.

4*a*. Mature leaf; 4*b*, buds; 4*c*, front and back views of anther; 4*d*, fruits. Toongabbie, near Parramatta, N.S.W. (Cuthbert Hall.) This is the type of *E. Marsdeni* C. Hall, which, in my view, is identical with *E. Penrithensis*.

E. micranthera F.v.M.

(See also Part XX, Plate 88.) In the former Plate the fruit is not given, as it was then unknown.

5*a*. Buds; 5*b*, fruits. Alexander River, Western Australia. (H. P. Turnbull.)

EUCALYPTUS LASERONI R. T. BAKER (*1-3*).
EUCALYPTUS de BEUZEVILLEI MAIDEN (*4*).
EUCALYPTUS MITCHELLI CAMBAGE (*5*)

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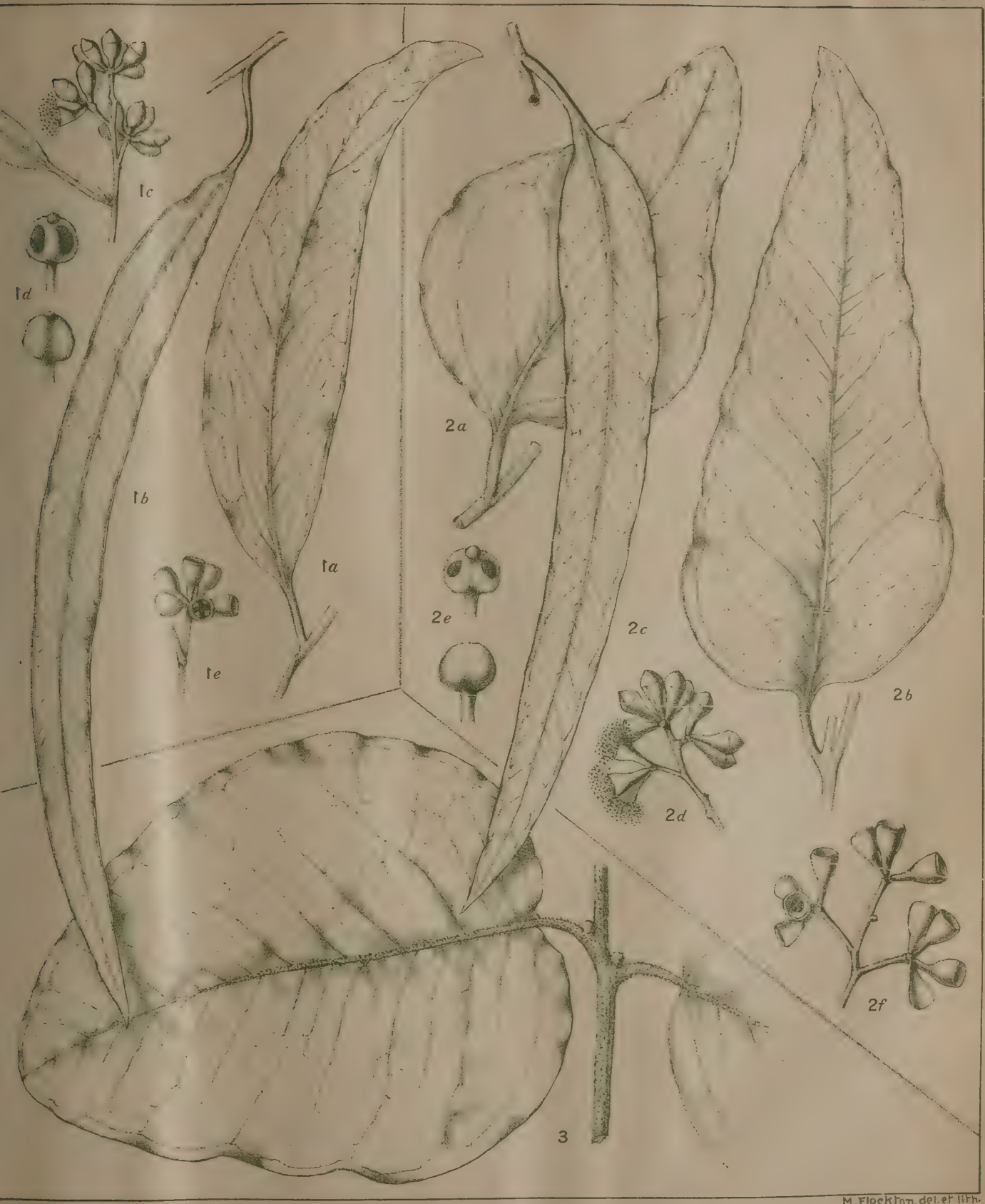

EUCALYPTUS BROWNII MAIDEN and CAMBAGE (*1*).
EUCALYPTUS CAMBAGEANA MAIDEN (*2*).
EUCALYPTUS MINIATA A. CUNN (*3*) [See Plates 95 and 96.]

EUCALYPTUS WOOLLSIANA R. T. BAKER.

(A composite species, mainly consisting of *E. odorata* BEHR and SCHLECHT. The drawings are all by Mr. Baker, or vouched for by him, except No. 4).

EUCALYPTUS PILLIGAENSIS MAIDEN (*1*, *2*).
EUCALYPTUS PENRITHENSIS MAIDEN (*3*), which = *E. Marsdeni* C. HALL (*4*).
EUCALYPTUS MICRANTHERA F.v.M. (*5*) [See also Plate 88.]

The following species of Eucalyptus are illustrated in my " Forest Flora of New South Wales"* with larger twigs than is possible in the present work; photographs of the trees are also introduced wherever possible. Details in regard to their economic value, &c., are given at length in that work, which is a popular one. The number of the Part of the Forest Flora is given in brackets :—

acacioides A. Cunn. (xlviii).
acmenioides Schauer (xxxii).
affinis Deane and Maiden (lvi).
amygdalina Labill. (xvi).
Andrewsi Maiden (xxi).
Baileyana F.v.M. (xxxv).
Baueriana Schauer (lvii).
Baueriana Schauer var. *conica* Maiden (lviii).
Behriana F.v.M. (xlvi).
bicolor A. Cunn. (xliv).
Boormani Deane and Maiden (xlv).
Bosistoana F.v.M. (xliii).
Caleyi Maiden (lv).
capitellata Sm. (xxviii).
conica Deane and Maiden (lviii).
Considenіana Maiden (xxxvi).
coriacea A. Cunn. (xv).
corymbosa Sm. (xii).
crebra F.v.M. (liii).
Dalrympleana Maiden (lxiv).
dives Schauer (xix).
dumosa A. Cunn. (lxv).
eugenioides Sieber. (xxix).
fruticetorum F.v.M. (xlii).
gigantea Hook. f. (li).
globulus L'Her. (lxvii).
goniocalyx F.v.M. (vi).
hæmastoma Sm. (xxxvii).
hemiphloia F.v.M. (vi).
longifolia Link and Otto (ii).
Luehmanniana F.v.M. (xxvi).
macrorrhyncha F.v.M. (xxvii).
maculata Hook. (vii).
melanophloia F.v.M. (liv).
melliodora A. Cunn. (ix).
microcorys F.v.M. (xxxviii).
microtheca F.v.M. (lii).
Muelleriana Howitt (xxx).
numerosa Maiden (xvii).
obliqua L'Hérit. (xxii).
ochrophloia F.v.M. (l).
odorata Behr and Schlectendal (xli).
oleosa F.v.M. (lx).
paniculata Sm. (viii).
pilularis Sm. (xxxi).
piperita Sm. (xxxiii).
Planchoniana F.v.M. (xxiv).
polyanthemos Schauer (lix).
populifolia Hook. (xlvii).
propinqua Deane and Maiden (lxi).
punctata DC. (x).
radiata Sieb., as *amygdalina* (xvi).
regnans F.v.M. (xviii).
resinifera Sm. (iii).
rostrata Schlecht. (lxii).
rubida Deane and Maiden (xliii).
saligna Sm. (iv).
siderophloia Benth. (xxxix).
sideroxylon A. Cunn. (xiii).
Sieberiana F.v.M. (xxxiv).
stellulata Sieb. (xiv).
tereticornis Sm. (xi).
tessellaris F.v.M. (lxvi).
Thozetiana F.v.M. (xlix).
viminalis Labill. (lxiv).
virgata Sieb. (xxv).
vitrea R. T. Baker (xxiii).

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A Critical Revision of the genus Eucalyptus

BY

J. H. MAIDEN, I.S.O., F.R.S., F.L.S.

(Government Botanist of New South Wales and Director of the Botanic Gardens, Sydney).

Vol. V. Part 8.

Part XLVIII of the Complete Work.

(WITH FOUR PLATES.)

"Ages are spent in collecting materials, ages more in separating and combining them. Even when a system has been formed, there is still something to add, to alter, or to reject. Every generation enjoys the use of a vast hoard bequeathed to it by antiquity, and transmits that hoard, augmented by fresh acquisitions, to future ages. In these pursuits, therefore, the first speculators lie under great disadvantages, and even when they fail, are entitled to praise."

MACAULAY'S "ESSAY ON MILTON."

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LXI. E. paniculata Sm.

In Mr. R. T. Baker's paper, "Some Ironbarks of New South Wales" (*Journ. Roy. Soc. N.S.W.*, ii, 410, 1917), the very important step was taken of splitting up *E. paniculata* into three species (*E. paniculata* Sm., with *E. Fergusoni* and *E. Nanglei* proposed as new), because of variation in the timber. It seems to me that the proposals add to the worries of both botanists and timbermen.

Variation in colour of timbers.—Mr. Baker (*op. cit.*, pp. 410–413) discusses the matter of variation in Ironbark timbers, and following are some of his observations. Thus, p. 410, "Under what has been commonly known as *E. paniculata*, it was found that several *distinct* [my italics] timbers occur . . . . ." Although he subsequently refers to other differences, they are vague, and his chief emphasis is in regard to colour.

In p. 412 ". . . . my experience . . . . is that Eucalyptus timber variations are not great wherever grown, especially colour of timbers, certainly not in a range of several colours."

In p. 413 we have ". . . . four distinct timbers, and . . . . it is difficult to admit that so wide a range of colours and qualities can exist under one species . . . . ." "If four distinct woods are to be placed under the same species-name, then it will be the exception to the *rule of constancy* [my italics] that I have so far found to obtain in our timbers." He then proceeds to take "the white, grey or light chocolate coloured timber as the type *paniculata*, then apart from other characters we have remaining, a deep chocolate timber, a pink timber, and a deep red one, for which names are required, and it is now proposed to give those specific rank."

So that the reasons for separating *E. Fergusoni* and *E. Nanglei* are based on differences in (1) timber, (2) "other characters," and we will consider these separately.

The coloured photographs of timber accompanying Mr. Baker's paper probably do not do his sections justice, but I see no great difficulty in placing those attributed to *E. Fergusoni* and *E. Nanglei* with *E. paniculata*, so far as colours are concerned.

The Rev. Dr. Woolls, in the letter quoted to me at p. 238, speaks of the variation of timber according to age, and also to the soil. We do not know, except in very general terms, the amount of variation in colour and other physical characters owing to environment.

I shall further deal with this matter of colour when I come to treat Eucalyptus timbers in general. It is a very difficult subject, for hardly two authorities describe the colour of a particular species in the same way.

Schlich (*Manual of Forestry*, v, 59) classifies "healthy, freshly-cut woods" of about twenty British and exotic timbers under the headings yellowish-white, bright yellow, greyish-yellow, brownish-yellow, reddish, reddish-brown, golden-brown, dark brown, black. He includes no Eucalypts.

He says, "Some woods may have different shades of colour, as oak, which is either dark or light. This shading of colour in woods may be very marked, and caused by variations of soil and rate of growth, more or less perfect formation of heartwood, &c. . . . . After wood has been kept for some time its colour usually deepens, and many bright-coloured woods become greyish."

Timbers vary in colour according as they are green, or seasoned or old. That is why so many timbers are described by some pale colour as white, pink, or pale, and subsequently as brownish, red, or dark.

In my first classification of the Ironbarks of New South Wales, in a paper read before the Sydney Architectural Association on 4th September, 1893, I speak of the timber of *E. paniculata* as "very pale, pink when fresh." In my "Notes on the Commercial Timbers of New South Wales" (Second Edition, 1904), I spoke of it (p. 7), as "often pale-coloured, even grey."

Every timber merchant knows that he has to grade his timbers of the same kind according to weight, colour, grain, &c. I am not referring to different species, but to grading within the same species. This is particularly the case in Northern Europe and North America, with timber of say Pine and Oak. In Australia, as regards our indigenous timbers, we have entered less into the refinements of grading, but even in such reputedly definite timbers as Jarrah, Tallow Wood, the Stringybarks and even the Ironbarks (now under discussion), the timber merchant recognises variations or grades. I have a block of She-oak timber on my study table. When I first had it, some years ago, it was fiery-red, almost loud; it is now an inoffensive reddish-brown or brown.

Speaking of *E. paniculata* timber at Part XIII, p. 104, I quote the late Augustus Rudder as to its variation in colour. He spent a long life in *E. paniculata* country, and was shrewd in regard to both botanical and timber differences. See also my remarks on "vernacular names" at p. 105 of the same Part.

Other Reputed Differences between E. paniculata and E. Fergusoni and E. Nanglei.

Quoting Mr. Baker, p. 411, ". . . . . it was found that the trees, in addition to having distinct timbers, differed also in variation of fruit, leaves and bark."

Mr. Baker does not publish a key to his species *Fergusoni* and *Nanglei* (in comparison with *E. paniculata*), and therefore we have mainly to fall back on the photographs of the fruits as shown in Plate XXI. My point is, elaborated at p. 227, that the forms all run into each other.

Page 419. *E. Nanglei.* There is a general absence of contrasted characters, an exception being, under *E. Nanglei*, "the whole plant being coarser than *E. paniculata* and the fruits are quite characteristic, the chief feature being the rim, which frequently flattens in pressed specimens . . . . differs from its type *E. paniculata* in . . shape of fruits . . . . In botanical sequence it may follow *E. Fergusoni*, although its organs differ considerably from that species."

In my anxiety to avoid duplication of drawings, particularly where there is a plate in the "Eucalyptographia," which is a work that should be read with mine, the drawings selected in the present work may sometimes give rise to some misunderstanding unless the above fact be borne in mind. The *Critical Revision* drawings are sometimes intended to bring out certain points. Turning to Part XIII, Plate 57, figs. 9*c* and 16, for example, see legend at p. 131, are intended to show that the fruits may be quite small or may have exserted valves. It does not mean that the form depicted is characteristic of this particular tree, for some of the fruits on this tree may be quite normal; it simply warns readers of an ascertained aberration in *E. paniculata*.

Further, the young foliage may become very coarse (large and thick), especially in exposed situations such as Ulladulla and Kincumber. Indeed the same thing is noticed at Dungog, and is by no means rare. In a comparatively dense forest the leaves may be thinner and smaller, with pale undersides. The figures now published of *E. paniculata* at Plates 196 and 197 should, taken in conjunction with Plate 57, be sufficiently comprehensive.

RANGE.

It is confined to coastal New South Wales and Queensland so far as we know at present. See Part XIII, p. 105. There is (1921) no satisfactory evidence that it occurs in Victoria.

The individual localities quoted at pp. 106, 107, will not be repeated. I have carefully gone over the specimens with the types of *E. Fergusoni* and *E. Nanglei* before me, and find that attempts to sort them out into three species are beyond my capacity. It is quite true that I am able to pick out some specimens in which the fruits match those particular fruits in the specimens which Mr. Baker has selected for his types, but they are associated with other characters which show that the forms cannot be segregated from *E. paniculata*.

E. paniculata is often found flowering in a dwarf state along the coast, particularly on north heads or headlets, *e.g.*, Ulladulla, Terrigal, First Point, Kincumber.

The list of localities which follows is to be added to those given in Part XIII, p. 106.

I may say that, in common with some other species which occur along the coast, exposed to the strong sea air, and also more inland, *E. paniculata* has larger coastal fruits. Incidentally it may be stated that the fruits of a species, wherever grown, may be larger if the product of a young vigorous tree, and smaller if near the top of a large tree.

New South Wales.

Forty feet high. Bermagui (Forest Guard W. Dunn). Boyne State Forest No. 147, 10 miles north of Bateman's Bay (Forest Guard L. Walker). About 20 feet high, North Head, Ulladulla (R. H. Cambage No. 4,070).

Heathcote, a few miles south of Sydney (J.H.M.). With suckers in the opposite stage.

Dundas (H. J. Rumsey). Parramatta to Penrith (Rev. Dr. Woolls). Ryde (F. R. Smith). Eurella-street, Burwood (J.H.M.). Lane Cove road, near Gordon (H. Deane). Near Golf Links, Killara (W. F. Blakely and D. W. C. Shiress). Near Gordon Station, on main road (W. F. Blakely). Pymble (W. A. Dixon).

Large tree, bark very rough and dark, younger branches nearly smooth. Asquith, near Hornsby (W. F. Blakely). Large tree of 50 or 60 feet. Bark a dull grey, very rough on barrel and main branches, and smaller ones somewhat smooth, with a few loose fragments of curly bark of 1 or 2 inches hanging from them. Near Oldham, Mt. Colah, near Hornsby (W. F. Blakely).

"A shrub about 10 feet high, growing on exposed hillsides on the coast near Terrigal. Growing in an almost horizontal manner, owing no doubt to its exposure to wind." (W. A. W. de Beuzeville, April, 1918). First Point, Kincumber (R. H. Cambage and J.H.M.). The juvenile foliage may attain as large a size as that of Wingello (fig. 11, Plate 57).

Raymond Terrace (E. Cheel). Grey Ironbark, Williams River (J. L. Boorman). Scrub Ironbark, Dungog (W. F. Blakely). The fruits from a very old tree are smaller. Nelson's Bay, Port Stephens (J. L. Boorman). Grey Ironbark. Good flow of good quality honey. Wauchope (W. D. Goodacre).

Settlement Lease No. 63, parish Wondoba, county Pottinger, poor hilly country. (Forest Guard M. H. Simon).

Torrington (J. L. Boorman).

Woodford Island, Clarence River (E. J. Hadley). "Grey Ironbark," Rappville, 17 miles from Casino (C. L. Campbell). Parish Dyraaba, county Rous, Casino; also Richmond Range (E. G. McLean).

Queensland.

Benarkin (Forest Inspector Twine, through C. T. White). Beenleigh (Dr. J. Shirley). Cabbage-tree Creek, Sandgate, with roots almost in salt water (C. T. White).

"Grey Ironbark." Waterworks-road, Brisbane (J. L. Boorman). Kedron; Mt. Gravatt. (Near Brisbane, C. T. White).

Aspley (E. Bilbrough). Fraser Island (W. R. Petrie).

Parish Boondooma, 70 miles north-west of Wondai (Forest Guard Higgins, through C. T. White). Gympie (L. Hirst).

"Grey Ironbark." Black heartwood. Blackbutt (R. W. Jolly).

I quote the original descriptions of both *E. Fergusoni* and *E. Nanglei.*

E. Fergusoni R. T. Baker, in *Journ. Roy. Soc. N.S.W.*, li, 415 (1917). (Bloodwood-bark Ironbark.)

Description.—A tall fine typical specimen of an Ironbark, with a facies in the field of something approaching a "Bloodwood," from the nature of the bark, which resembles somewhat those species of Eucalypts. It is probably the thinnest bark of all the Ironbarks, and lacks the deep furrows so common to the group, being friable and so very short in the fibre on the exterior half, but hard and compact and deep red in colour for the remaining thickness, there being almost an entire absence of kino. The early leaves, say two or three, are at first rather broadly lanceolate, from 7 to 9 inches long and 2½ to 3 inches broad, but later leaves much smaller and less coriaceous than the earlier ones, venation distinct, intramarginal vein removed from the edge, lateral veins medium oblique. Normal leaves lanceolate, falcate, varying in length and width, and may be described in a general way as only medium size for an ironbark, not thick; venation not at all distinct as a rule, intramarginal vein removed from the edge, lateral veins fairly oblique. Inflorescence paniculate-corymbose, but when developed into the fruiting stage becoming almost corymbose. Calyx pyriform, ribbed. Operculum conical, the rim of the calyx bulging beyond the base of it. Fruits pear-shaped on a long slender pedicel, strongly four-ribbed, contracted at the rather thin rim, valves deeply inserted, 9 lines long and 4 lines wide.

Timber.—The colour is a deep red or reddish chocolate when fresh cut, but rather inclined to become a lighter red when aged. It is hard, heavy, straight or interlocked in the grain, which may be described as rather open, the vessels being conspicuous in a longitudinal cut, and appearing as whitish streaks. It planes and dresses well, and is suitable for all kinds of heavy constructional works.

In its economics it is probably equal to the very best of other Ironbarks, such as *E. crebra*, *E. paniculata*, *E. siderophloia.*

Then follows an account of the microscopic structure of the timber.

Geographical Range.—Bulladelah and Wingello.

(I have received from Mr. Baker a specimen labelled Bulladelah (L. C. Maxwell, October, 1916), as typical for *E. Fergusoni.*)

Affinities.—It is not easy to place this species in its systematic sequence, as whilst timber places it near *E. siderophloia*, the bark, leaves and fruits especially differentiate it from that species, as these features also do from other described species of Ironbarks, *E. crebra*, *E. paniculata*, *E. sideroxylon*, *E. Caleyi*, *E. drepanophylla.*

It might be placed between *E. siderophloia* and the pink Ironbark of this paper, *E. Nanglei.* (Original description.)

"Research has shown that the timber of this tree was exhibited at the Paris International Exhibition of 1862, under the name of *E. crebra*, but later this name was changed on the specimen fto *E. paniculata.*" (End of original description.)

Following are my own comments :—

1. The word Paris in connection with 1862 is, of course, a slip of the pen. No specimen of an Ironbark timber named as to species was exhibited either in the Paris Exhibition of 1855, or in the London Exhibition of 1862.

2. The "timber of this tree" refers to one of a number of little hand-samples, being Sir William Macarthur's reference set (it was he who made the New South Wales timber collections for these exhibitions). These were spoken about to me by Sir William at Camden Park in February, 1881, and some years later they were presented by Mrs. Macarthur Onslow, his niece, and placed by me in the Technological Museum.

3. I spent much time on these specimens (including those which are Ironbarks) between the years 1885 and 1896 (when I was transferred to the Botanic Gardens), with the printed catalogues of these Exhibitions before me, and made some notes. The gist of those notes, as regards Nos. 1, 3, 8 of the specimens of the London Exhibition of 1862, will be found at Part XIII, p. 106, of the present work, under *E. paniculata*, and a reference to *E. crebra* will be seen. The name *crebra* was marked by me on a specimen, and afterwards changed by me to *paniculata*. All this happened many years ago, and I think *paniculata* is probably correct.

E. Nanglei R. T. Baker, in *Journ. Roy. Soc. N.S.W.*, li, 418 (1917), with three figures of the fruit at Plate 21. (Pink Ironbark.)

Description.—An average forest tree with a very thick, compact, deeply furrowed bark, containing large quantities of kino. Leaves lanceolate, the early-growth leaves might be described as broadly lanceolate, and of a thin texture; veins finely prominent, and not very oblique; usual leaves mostly straight, lanceolate, venation not at all prominent; lateral veins oblique, and more so than in the earlier leaves; intramarginal vein rather close to the edge. Inflorescence paniculate or axillary at the neds of the branchlets but in the fruiting stage, the leaves having fallen, the capsules appear in quite a paniculate form. Buds under an inch long, calyx pyriform; operculum conical. Fruits inclined to pilular, constricted at the rather short pedicel or pyriform, more or less contracted at the rim, where it is more or less flat or broad; in some instances very slightly ribbed at the base or pedicel, valves not exserted, or just a little so.

Timber.—A very fine timber with a distinct clear pink or red colour, and having the facies rather of *E. rostrata*, *E. tereticornis*, or *E. propinqua*, than that of an Ironbark. It may be described as close-grained, heavy, hard, but does not plane to so bony a face as Ironbarks, having a tendency to splinter up almost immediately after planing. It is not so heavy as other Ironbarks, probably being the lightest in weight of any of them.

General.—The timber of this tree is quite distinct from the White or Grey Ironbark of this paper, and the two could not be correctly placed under one species, especially in a public collection of timbers such as obtains in the Technological Museum. No tradesman or timber expert would pass them as one and the same wood, and it was these particular differences that influenced me to separate these trees as distinct. The bark is not so deeply furrowed nor quite so thick as in most Ironbarks, but has a fair amount of kino scattered throughout its structure, the inner layer is also thinner for so large a tree. It is also easy of determination in herbarium material, and the whole plant being coarser than *E. paniculata*, and the fruits are quite characteristic, the chief feature being the rim which frequently flattens in pressed specimens.

It is difficult to trace references to this tree, but it is just possible that, owing to its paniculate inflorescence, it may have been confounded with *E. paniculata*, and perhaps Dr. Woolls, when first recording the colour of the wood of *E. paniculata* as Red may have had material of this species, *vide* remarks by J. H. Maiden under *E. paniculata*.

This species differs from its type *E. paniculata*, principally in the physical properties of its timbers, such as colour and texture, also in inflorescence, shape of fruits and nature of bark, and the same remarks apply to other Ironbarks. In botanical sequence it may follow *E. Fergusoni*, although the organs differ considerably (they have not been stated, J.H.M.) from that species, as well as from the other Ironbarks.

Geographical Range.—It has a wide range, preserving its specific features well throughout its distribution. Localities at present known to me are Morisset, Stroud, Bulladelah, Woy Woy, Lindfield, Nowra. (End of Mr. Baker's description.)

I have picked out a number of herbarium specimens whose facies most generally resemble that of *E. Nanglei* as represented by the specimens presented by Mr. Baker, but they run into *E. Fergusoni* and both into *E. paniculata* inextricably.

DESCRIPTION.

CCLXXIV. E. decorticans sp. nov.

Arbor magna, cortice nigricante dura sulcata, *E. siderophloiae* similibus; ramis albis, laevibus, deciduis, ligno rubro mediocre; foliis junioribus angustissimis lineari-lanceolatis vel lanceolatis; foliis maturis lanceolatis utrimque aeque viridibus, venis (praeter costam mediam) inconspicuis; calycis tubo obconico in pedicellum brevem angustato; operculo plerumque obtuso; fructu ovoideo-cylindrico, 7 mm. diametro, valvarum apicibus paulo exsertis.

Bark.—On the butt blackish, hard, furrowed, with flattish ridges after the fashion of *E. siderophloia* but with bare branches as described by Dr. T. L. Bancroft in the following extract from a letter:—"A remarkably fine tree, like a large Grey Ironbark, but the branches of the top, up to the size of a man's arm or even thicker, are white in colour; covered with a thin, smooth bark; the bark is always peeling off these thin branches, and the ground below is strewn with it after the style of *E. hemiphloia*."

Timber inferior in quality, colour red.

Juvenile leaves.—Extremely narrow, linear lanceolate to lanceolate, some specimens having an average length of 5 or 6 dm. and a diameter of 8 cm., oil dots abundant.

Mature leaves.—Lanceolate, slightly curved, acuminate, equally green on both sides, drying to a pale green, venation (except the midrib) inconspicuous, the lateral viens very fine and somewhat spreading, the marginal vein close to or very near the edge.

Flowers.—Umbels three to six flowered, usually three or four together in short axillary or terminal panicles, the peduncles angular. Calyx-tube obconical with one or two angles, tapering into a short pedicel. Operculum usually blunt-pointed, about as long as the calyx-tube. Stamens inflected in the bud, anthers broad, white, opening at the sides, filament at the base, small gland at the top.

Fruit.—Ovoid cylindrical, and 7 mm. in diameter, often with one or two angles, with a darker coloured rim hardly constructed at the orifice, the tips of the valves slightly protruding.

This form is known as "Mountain Ironbark," "Naked Top Ironbark," or "Gum Top."

This description is based on one in *Journ. Roy. Soc. N.S.W.*, xlvii, 80 (1913), but we have acquired additional information concerning it, and it now seems distinct, and therefore a name should be given to it. I have therefore pleasure in bringing Mr. F. M. Bailey's forma *decorticans* (of *E. siderophloia*) up to specific rank, if that be admissible. I take the opportunity (in addition to the name of Dr. Bancroft already quoted) of saying how indebted I am to Mr. C. T. White, the Government Botanist of Queensland, for valuable help.

SYNONYM.

E. siderophloia Benth. forma *decorticans* Bailey, in *Queensland Agric. Journ.*, xxvi, 127 (March, 1911).

"This tree resembles the narrow-leaved forms of the species (*siderophloia*), differing principally in the bark of the branches, even when as thick as a man's arm, being deciduous." (Complete original description.)

RANGE.

So far as we know at present it has only been received from the Burnett River district of Queensland. It was originally sent by Dr. T. L. Bancroft, its discoverer, from Eidsvold, where it occurs on rocky mountainous country, associated with *E. siderophloia*. Mr. Forest Guard S. J. Higgins (sent by Mr. C. T. White), collected it in the parish of Boondooma, but there is no doubt that, having been confused with other Ironbarks, it has an extensive range.

AFFINITIES.

With *E. drepanophylla* F.v.M.

In *Journ. Roy. Soc. N.S.W.*, xlvii, 80, I considered *E. decorticans* to be specifically identical with *E. drepanophylla*, but additional material has caused me to form a different opinion. Phylogenetically, *E. drepanophylla* may be looked upon as a coarse form of *E. crebra*, and most observers do not discriminate between those two species, many of the references to *E. crebra* including *E. drepanophylla*. It is possible that *E. decorticans* has, like *E. drepanophylla*, evolved from *E. crebra*. I attach great importance to Dr. Bancroft's observations. He says *E. decorticans* is a denizen of dry, rocky hillsides, while *E. crebra* grows on flatter country. *E. decorticans* has a deciduous bark on the branches, and a poor timber, differing from *E. crebra* in both these respects.

The anthers of *E. decorticans* are semi-terminal, or approaching the group provisionally termed Porantheroid; those of *E. drepanophylla* are small, opening in parallel slits, simulating those of *E. crebra*.

Partly because of the narrowness of the juvenile leaves (borne out, I may say, in the seedlings), I wrote to Dr. Bancroft about the relation of the new species (*decorticans*) to the widely diffused *E. crebra*. He replied: "I am absolutely certain that the sucker leaves are extremely narrow, more so a lot than those of *E. crebra*. The new species and *E. crebra* do not grow together." In another letter he says that they are as narrow as those of *E. Seeana* Maiden. See fig. 1*a*, Plate 132, Part xxxii, of the present work.

DESCRIPTION.

CCLXXV. E. Culleni R. H. Cambage.

In *Journ. Roy. Soc. N.S.W.*, liv, 48 (1920), with Plate 1.

Following is the original description :—

Arbor alta quadraginta vel quinquaginta pedes, trunci diametrum unciarum duodeviginti ad duo pedes habens.

Folia matura.—Linearia-lanceolata circiter sex ad quattuordecim cm. longa, octo mm. ad 1·5 cm. lata, cum apicibus directis vel uncis, interdum leviter falcata, utrobique cinerose viridia, glabrosa, costa media clara, venae laterales aliquanto obscurae et dispositae angulo circiter 45° ecosta, margines plerumque quasi nervi vena intra marginem juxta extremitatem, olei glandulae parvae sed numerosae, petiolus a quinque mm. ad unum cm. longus.

Gemmae globosae, tubus calycis hemisphericalis duo mm. longus, diametrus quattuor mm. habens, operculum simile tubo calycis, terminatum cuspide brevi circiter ·5 mm. longa, pediculi circiter quinque mm. longi, pedunculi teretes a quinque mm. ad 1·1 cm. in parte intera paniculae.

Flores pedicellati, umbellae in paniculis terminalibus vel nonnullae in axillis superioribus, cum floribus a tribus ad septem, antherae parvae patentes late laterale, glandula a tergo filum a fundamento.

Fructus hemisphericales tres ad quattuor mm. longi, diametrum a sex ad septem mm. habentes, ora excitata, circiter 1·5 mm. lati, valvae exsertae, pedunculi a quinque mm. ad 1·2 cm. longi.

Cortex dura, aspera et sulcata.

Lignum rubrum, durum et durabile, consuetissimum in fodinis apud " Chillagoe."

A tree of 40–50 feet high, with stem diameter of 18 inches to 2 feet.

Mature leaves linear-lanceolate, from about 6–14 cm. long, 8 mm. to 1·5 cm. broad, with straight or hooked points, sometimes slightly falcate, greyish-green on both sides, glabrous, midrib distinct, lateral veins rather obscure, and arranged at an angle of about 45 degrees with the midrib, margins usually nerve like, intramarginal vein close to the edge, oil glands small but numerous, petiole 5 mm. to 1 cm. long.

Buds globular, calyx-tube hemispherical, 2 mm. long, 4 mm. in diameter, operculum similar to calyx-tube, terminating in short point about ·5 mm. long, pedicels about 5 mm. long, peduncles terete, 5 mm. to 1·1 cm. in the lower portion of the panicle.

Flowers pedicellate, umbels in terminal panicles or some in the upper axils, with three to seven flowers, anthers small, opening widely laterally, gland at back, filament at base.

Fruits hemispherical, 3–4 mm. long, 6–7 mm. in diameter, rim raised, about 1·5 mm. broad, valves exserted, peduncles 5 mm. to 1·2 cm. long.

Bark hard, rough and furrowed.

Timber red, hard and durable, much used in the Chillagoe mines.

The species blooms in March, and I am indebted to Miss Ethel K. Maitland for flowers.

Reversion (" sucker ") **foliage.**—Ovate-lanceolate, 3–7 cm. long, 5 mm. to 2 cm. broad, so far as seen.

Seedlings.—Hypocotyl terete, red, 3 mm. to 1 cm. long, 1 mm. thick at base, glabrous.

Cotyledons obtusely quadrilateral to reniform, entire, 2·5–3 mm. long, 4–7 mm. broad, upperside green, underside red; petiole 3 mm. long.

Stem brownish-red in lower portion, brownish-green in upper part.

Seedling foliage opposite for about two or three pairs, entire, glabrous, linear; petiole 2–4 mm. First pair 1·6–2·4 cm. long, 1–2 m.m broad, upperside green, underside purple; leaves Nos. five to ten up to 5 cm. long, 2–3 mm. broad.

A seedling about one foot high has an opposite pair of nodules or swellings* about the axils of the cotyledons or the first pair of leaves.

The species is named in honour of Sir William Portus Cullen, K.C.M.G., M.A., LL.D., Chief Justice of New South Wales and Chancellor of the University of Sydney, who has done much to encourage the preservation of our native flora.

RANGE.

It is confined to North Queensland, so far as we know at present.

Alma-den, 121 miles by rail westerley from Cairns, tropical Queensland, about 1,600 feet above sea-level, growing on granite formation containing about 68-70 per cent. silica, and known as Ironbark. (No. 3,905, collected August, 1913.) Mr. J. H. Maiden informs me that he received an incomplete specimen of this species from Chillagoe in 1911. (Original description.)

AFFINITIES.

Its closest affinity appears to be with *E. crebra* F.v.M., which it resembles in bark, timber, and mature leaves, but differs in the shape of buds and fruits, and in the seedling foliage. It also resembles *E. paniculata* Sm., in its bark, but differs in the timber and other characters.

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* "On Certain Shoot-bearing Tumours of Eucalypts and Angophoras," by J. J. Fletcher and C. T. Musson. *Proc. Linn. Soc. N.S.W.*, vol. xliii, p. 191 (1918).

DESCRIPTION.

CCLXXVI. E. Beyeri R. T. Baker.

In *Journ. Roy. Soc. N.S.W.*, li, 420 (1917), with figure of the fruit. Syn. *E. paniculata* var. *angustifolia* Woolls (sic.). See p. 236. (Narrow-leaved Ironbark.)

FOLLOWING is the original description :—

A tree with a tall giant stem, surmounted with rather a straggling, sparsely-leaved head. Bark hard, heavy, very thick, permeated with kino. Leaves lanceolate throughout, those of the early stage very narrow lanceolate, thin, almost membranous, average foliage leaf wider in proportion to the length, not thick, the base tapering and evenly balanced, oblique or rounded. Venation in some cases well marked. Buds small, calyx tapering into a proportionately long and slender pedicel; operculum conical. Fruits pyriform, shining, pedicel slender, rim thin, valves attached at the base below the rim, not exserted, 3 lines long and 2 lines in diameter.

Timber.—A dark chocolate-coloured timber, mostly interlocked, heavy, very hard, and having a great reputation for durability; and so is one of the finest Ironbarks of the country. It could be used for all kinds of heavy constructional works, such as wharves, beams, posts, bridges, heavy carriage, and coach work. It is a valuable timber, and not easily confounded with any other yet described.

(Then follows a description of the microscopic characters of the timber, which can be referred to in the original). Irving W. Bailey, in *Journal of Forestry*, xv, 176 (February, 1917), gives a warning note as to the use of the microscope for timber diagnosis.

Mr. Baker's type is figured at fig. 1, Plate 199, and it will be seen that it is impossible to separate it from fig. 21, Plate 57.

Named after Mr. George Beyer, who for several years was Herbarium Assistant in the Technological Museum, and in which capacity he did much to help on the researches in economic botany, and still continues to do so in his office of chief clerk in that institution. (End of original description.)

It will be noticed that there is no reference in the original description to the anthers so far as their dehiscence is concerned, and the only reference to the stamens is " outer stamens anantherous " (Woolls). The opportunity of making a pronouncement on this essential point was not availed of (p. 420).

SYNONYM.

E. paniculata Sm. var. *angustifolia* Benth.

The name *E. paniculata* var. *angustifolia* Woolls, as quoted by Mr. Baker, was adopted (not created) by Woolls.

AFFINITIES.

The affinity of *E. Beyeri* as regards anthers (see fig. 3*d*, Plate 199) is with *E. paniculata*, and not with *E. crebra*, which it often closely resembles in narrowness of leaves, slenderness of branchlets, smallness of fruits; and it seems to me, the question is whether it should be considered (as Bentham and Woolls considered it), as a form of *E. paniculata*, if its specific rank be not conceded. The anther of *E. crebra* has a small gland at the top, and it is comparatively broad at the base. In *E. paniculata* and *E. Beyeri* the anther is broad at the top.

E. Beyeri has been known for at least half a century, and let us consider what has been written about it.

A. Bentham's views :—

"*Eucalyptus paniculata* Sm. var. *angustifolia*. Leaves narrow and thin, as in some varieties of *E. crebra*. Umbels loose, paniculate. Operculum conical. Outer stamens anantherous. New South Wales, "Narrow-leaved Iron-bark," *Woolls* (B.Fl. iii, 212, 1886).

Woolls' specimens for the Flora Australiensis would have been forwarded to Bentham some years ago with notes on the labels.

B. Rev. Dr. Woolls' views :—

1. "A contribution to the flora of Australia" (1867). In writing the later chapters of this work, Mr. (afterwards Rev. Dr.) Woolls had Bentham's views before him. At p. 242 he says :—

Speaking of *E. paniculata* and *E. crebra* : these are mere varieties of the 'white Iron Bark,' one of the most valuable trees in the colony. . . . I feel no hesitation in uniting *E. paniculata* and *E. crebra* as one species, although there is an occasional difference in the quality of the wood, and in the size of the flower-buds as well as in the texture of the leaves. In the form *angustifolia*, the flowers are very small, and bear a great resemblance to those of *E. bicolor*, or the Bastard Box.

2. *E. angustifolia* is regarded as a variety of *E. paniculata*, but the workmen, judging only from the wood, call it a distinct species, by the name of the Narrow-leaved Ironbark. (*Lect. Veg. Kingd.*, 123, 1879.)

I think this is a slip of the pen for *E. paniculata* var. *angustifolia* Benth. *E. angustifolia* Woolls is a *nomen nudum* for lack of description, and if it were not, the name is preoccupied by *E. angustifolia* R.Br., a synonym of *E. amygdalina* Labill. See Part VI of the present work, p. 151.

3. In "Plants indigenous in the neighbourhood of Sydney" (1880 edition), under Schizophloiæ, we have "*E. crebra* F.v.M., *E. paniculata* Sm., and also *E. sp.*, doubtful," which is not the variety *angustifolia* above referred to.

4. In a paper, "Eucalypts of the County of Cumberland" (*Proc. Linn. Soc. N.S.W.*, v. 293 (1881)), under Schizophloiæ, we have "*E. sp.* F.v.M.; *E. crebra* F.v.M.; and *E. paniculata* Sm., and var. *angustifolia* Benth."

5. "He (Rev. Dr. Woolls) again refers to it in *Proc. Linn. Soc. N.S.W.*, 1880, p. 503, as only to be distinguished from *E. crebra* by having its outer stamens anantherous, although practical men easily distinguish them by their wood and bark." (Quoted by Mr. Baker.)

This is a reference to Vol. V (1881), and we have, in a continuation of the preceding paper, dealing with the Schizophloiæ, "*E. paniculata* varies in the colour of the wood from white to red, and, therefore, is sometimes called 'White' and sometimes 'Red Ironbark,' while on the Blue Mountains the pale variety has the name of 'Brush Ironbark' . . . . . , and in dried specimens var. *angustifolia* is only to be distinguished from *E. crebra* by having its outer stamens anantherous, although practical men easily distinguish them by their wood and bark."

Under *E. crebra* he says: "According to the artificial (Bentham's anthereal) system, *E. crebra* stands in the same section with *E. siderophloia*, though, in its general character, it approaches more closely to the narrow-leaved forms of *E. paniculata*."

6. In "The Plants of New South Wales" (1885), at p. 51, we have, under *E. paniculata*, "There is a narrow-leaved variety of this species very similar to *E. crebra*, and it can scarcely be distinguished but by the opening of the anthers."

7. See the paragraph referring to *E. paniculata*, "There is also a tree . . . . colour and touch," in Dr. Woolls' letter to me of 26th September, 1888, below.

8. In "Plants indigenous and naturalised in the neighbourhood of Sydney" (1891), p. 26, we have enumerated "*E. crebra* F.v.M.; also *E. paniculata* Sm. and var. *angustifolia*."

The Rev. Dr. Woolls' name has been a good deal quoted in regard to *E. paniculata* and other Ironbarks. I corresponded with him many times in regard to this very subject, and I even took a house at Burwood, near Sydney, where I lived for some years, in order that I might be near him, and I was in his house scores of times for botanical chats, often illustrated by specimens. We often walked about Burwood, Strathfield, Concord, to examine trees he had studied, while he directed my attention to specific trees at Parramatta, Rossmore (then Cabramatta), Bringelly, Richmond, the Kurrajong, chiefly referred to in his writings, which I visited as directed by him. So that I know fairly well his views on County of Cumberland Ironbarks, at all events during the last few years of his life. Following are extracts from one of his Burwood letters of 26th September, 1888, referring to *E. panicutata*:—

The common names of *E. paniculata* are White, Pale, Grey, She, Narrow-leaved Ironbark. In some forms of this species the leaves are similar to that of *E. crebra*, but the anthers are of a different shape and the wood paler in colour. . . . The true Narrow-leaved Ironbark is *E. crebra*. It occurs between Sydney and the Mountains (Blue) occasionally, but it abounds at the Kurrajong.

When Sir William Macarthur collected for the Paris Exhibition of 1867 (the New South Wales Catalogue of timbers at the Paris Exhibition of 1867 is a facsimile of that of the London Exhibition of 1862, already referred to, J.H.M.), he had nine logs of Ironbark from the Counties of Cumberland and Camden, and I was the person who called his attention to the Red-flowering Ironbark (*E. sideroxylon*). He calls *E. paniculata* White or Pale Ironbark, and says it is the most valuable of all the Ironbarks. I

had several conversations with Sir William about the woods, but at the time he was collecting the third volume of our Flora Australiensis had not arrived in the colony, and so there was a difficulty in determining the species.

There is also a tree (of which I am not certain) called Scrub or Brush or Forest Ironbark—so-called at the Kurrajong—I referred to *E. paniculata*, whose bark was not so furrowed as the species near Sydney, and the wood was reported to be light in colour and tough. (This is *E. Beyeri*. J.H.M.)

I have been assured by practical men that the timber varies in proportion to age, and also to the soil in which it grows.

C. Mueller's views :—

E. angustifolia Woolls, "Lectures on the Vegetable Kingdom," p. 123, is a form of *E. crebra*. It seems not likely that *E. paniculata* will ever be taken for *E. crebra*, as the leaves of the latter are never much unlike in the colour of their two pages, as all the stamens are fertile, the anthers opening in their whole length, and the fruits usually smaller and angular. ("Eucalyptographia," under *E. crebra*.)

E. crebra and *E. microcorys* are also not dissimilar to *E. paniculata*, and mere fruiting twigs of these three might easily be referred to the wrong species, but in a flowering state the mode of dehiscence of the anthers distinguish them easily from each other, irrespective of several other characteristics. ("Eucalyptographia," under *E. paniculata*.)

D. Mr. Baker's views :—

1. In general features, such as leaves, buds, fruits, it very closely resembles *E. crebra*, and from herbarium material alone might easily be mistaken for *E. crebra*, but the timber at once readily differentiates it from that species. . . .

2. With *E. paniculata* Sm. "The chief differences from the type of *E. paniculata* are the shape and size of the fruits, shape of the leaves, timber and bark. In botanical sequence it may be placed after the type *E. paniculata*. . . ."

The chief features are so distinct from the type *E. paniculata*, that it is now proposed to raise it to specific rank under the name of *E. Beyeri*.

3. In p. 420, general statements as to affinities to *E. crebra* and *E. paniculata* are made—"from herbarium material alone (it) might easily be mistaken for *E. crebra*. . . . In botanical sequence it may be placed after the type *E. paniculata*. . . ." "The chief features are so distinct from the type *E. paniculata*, that it is now proposed to raise it to specific rank," &c.

As in other proposed species referred to in this paper, the chief reliance is made on difference in the timber. "The timber alone readily differentiates it from that species" (*E. crebra*), (p. 421).

Previously (p. 420), "It is . . . not easily confounded with any other (timber) yet described."

So far I have spent a good deal of time examining timbers connected with herbarium specimens of *E. paniculata*, and also of pieces of *E. Fergusoni*, *E. Nanglei* and *E. Beyeri*, certified to by Mr. Baker himself. Nor have I relied entirely on my own judgment. I find them all brown, particularly either when kept or taken from an old tree. Of the specimens in my care, that of *E. Fergusoni* is the reddest, though in most *E. paniculata* timbers there can be detected some red, particularly in a suitable light. It is because the timber of *E. Beyeri* seems, so far as my specimens go, the brownest of the lot, that (taken in conjunction with the morphological characters) I think *E. Beyeri* is worthy of specific rank. But the species is still somewhat unsatisfactory, and, like some others of our species, requires further investigation.

RANGE.

"This tree seems rather restricted in its geographical range, being so far only recorded from Kingswood and St. Mary's, New South Wales." (Original description.)

Following are specimens which I attribute to *E. Beyeri*, and which are in the National Herbarium, Sydney. See also the notes with the description of Plate 199, as given at p. 260.

G. Caley's specimens, from the British Museum. The words between inverted commas are in Caley's handwriting:—

A. "Ironbark, N. Beach, 13th June, 1804. Thrown down by parrots." British Museum, No. 33.

B. "Torrangora (St. ? Street) boundary. November, 1806. Got by Dan." British Museum, No. 12.

C. "Mogargro, South Brush. Got by Dan" (evidently an assistant, aboriginal, or other). British Museum, No. 27.

Parramatta River, Parramatta (W. F. Blakely and D. W. C. Shiress). Ermington Park, Ermington (W. F. Blakely).

XCVIII. E. globulus Labill.

SYNONYMS.

1. *E. globulus* Labill., var. *St. Johni*, R. T. Baker, *Journ. Aust. Assoc. Adv. Science*, xiv (January, 1913). Also *E. St. Johni*, R. T. Baker.
2. *Vict. Nat.*, xxx, 127 (November, 1913).

As regards the first reference, Mr. Baker says: "Or *sp. nov.* . . . Tentatively placed as a variety." The description, however, is not sufficient for a new species, nor indeed has the brief Latin description been given, as required by botanical law. Then we have "On a new variety of *Eucalyptus globulus—E. globulus*, var. *St. Johni.*," by R. T. Baker, in *Vict. Nat.*, xxx, 127 (November, 1913).

Following is the paper:—

The Blue Gum, *Eucalyptus globulus* Labill., has such an extensive range from Southern Tasmania through Victoria to the north of New South Wales, and preserves such a constancy of general morphological characters, that a departure from the normal is of systematic interest; and the honour is due to a Victorian for unearthing this variety. It was discovered by Mr. P. R. H. St. John, on the banks of the Lerderberg River, Bacchus Marsh district, 5th November, 1903, so that at present its location is restricted; but this appears to be the general rule when new species or varieties are discovered. At least a hundred similar trees are growing in the neighbourhood, and there is little doubt but that it will be found to be more widely distributed later on.*

The other species of Eucalypts growing within a square mile of this particular tree are as follows:—*E. amygdalina, E. Behriana, E. elæophora, E. leucoxylon, E. melliodora, E. macrorrhyncha, E. hemiphloia, E. polyanthemos, E. sideroxylon, E. viminalis.*

The material collected by Mr. St. John is quite complete, consisting of (*a*) seedling; (*b*) adventitious shoots, obtained from branch of tree 8 feet from the ground, the tree about 20 years old; (*c*) leaves from a young tree 6 feet high; (*d*) leaves from young tree 12 feet high; (*e*) twig from mature tree, with early buds, mature buds and flowers; (*f*) twig with fruits from mature tree. The young seedlings have ovate-lanceolar, acuminate, petiolate leaves, glaucous above, under surface purplish; the cotyledons or seed-lobes are on slender stalks, and deeply bi-lobed.

(*a*) The older seedling leaves are oval, sessile, or shortly petiolate, and slightly or not at all cordate; shortly acuminate; not large, about 1½ inches to 2 inches long, and ¾ inch to 1¼ inch or more wide; pale and glaucous on the under side, oil-dots numerous, stem terete, branchlets square.

(*b*) Similar in shape to those of (*a*), only longer.

(*c*) The leaves of the adventitious shoots are longer, orbicular, cordate, lateral veins slightly oblique, parallel, and looping some distance from the edge; branchlets rectangular.

(*d*) These are large, petiolate, oval, to oval-lanceolate, showing intermediate stage to normal leaves.

(*e*) This is an interesting specimen, as it shows the inflorescence in every stage. The early stages are characterised by a calyptra, covering two or three buds. The mature buds are more like those of *E. Maideni* than *E. globulus*, and differ from the latter in the absence of a second operculum. The calyx is compressed, sessile, about ¼ inch long, ¼ inch and less in width, operculum acuminate, depressed, tuberculate, stamens inflexed before expansion; anthers parallel, opening by longitudinal slits.

* This variety has since been discovered in South and East Gippsland. R.T.B.

Normal leaves lanceolate, falcate, as in the type, with similar venation, 2 inches to 2 feet or more in length, ½ inch to 3 inches broad, on petioles varying from 1 inch to 2 inches long; oil-dots conspicuous.

The fruits of this variety differ considerably in size and other features from the type; they measure about ¼ inch long to ½ inch in diameter.

The edges of the compressed calyx are here seen to have developed into slightly broken ridges; there is quite an absence of the tubercles so pronounced a feature on the type; the rim is sharp and well defined, and slopes down or upwards to the summit of the valves, that vary in number from two to four.

It is the seedling leaves, the presence of a calyptra in the early buds, the absence of double opercula and the fruits which justify, in my opinion, the tree being given varietal rank.

Then follows a plate of fruits of *E. globulus* and of the variety, but, unfortunately, they are reduced in size, and, therefore, not easy to interpret. However, in 1920, in the work about to be referred to, Mr. Baker speaks of *E. St. Johni* as if he had described it.

The references to the species in " Research on the Eucalypts " (Baker and Smith, 2nd ed., 1920) are trivial, and are as follows :—

Page 165 (under *E. globulus*). " A small, smooth-fruited form that has a wide distribution, and seed distributed abroad, is not *E. globulus*, but *E. St. Johni* R.T.B."

Page 287 (under *E. coccifera*). " The sessile fruits are near perhaps to those of *E. St. Johni*, except that this rim is nearly flat."

Surely this is not the way to describe a species at the close of the second decade of the twentieth century.

AFFINITIES.

1. With *E. globulus* Labill.

From type specimens placed at my disposal, the fruits of *E. St. Johni* (and the reputed differences from *E. globulus* turn on the fruits), are figured at fig. 10, Plate 79, Part XVIII, of the present work. The buds are roughened or tubercled. The points made are that the fruits are sessile, small, and smooth. Neither is a constant character as distinct from *E. globulus*. See the above plate. Most fruits of *E. globulus* are sessile. As to size, the fruits vary from even smaller than described by Mr. Baker as for *E. St. Johni*, to the very large fruits of *E. globulus* found in Tasmania. As regards smoothness, examination of Plate 79 will show that the character is not rare in *E. globulus*. See figs. 9*a*, *b*, *c*, and it will be observed that we may have roughness and smoothness, with a considerable amount of variation in size, in the same restricted area of trees. In my view, it is not a species, as distinct from *E. globulus*, and from what I have just said, its acceptance as a variety would be likely to cause confusion.

2. With *E. Maideni* F.v.M.

For this species, see Plate 80 of Part XVIII. As regards size and smoothness of the particular fruit chosen as typical of *E. St. Johni*, these characters are common enough in *E. Maideni*, which may be both sessile and pedicellate. But whether *E. St. Johni* can stand as a species can best be discussed under *E. globulus*.

CCLXXVII. E. nova-anglica Deane and Maiden.

In *Proc. Linn. Soc. N.S.W.*, xxiv, 616 (1899), with a plate.

THE description is given at Part XXI, p. 9, of the present work, and need not be repeated. It is figured at figs. 3–4, Plate 90, and as these are adequate no further illustrations are given.

SYNONYM.

E. cinerea F.v.M., var. *nova anglica* Maiden, in Part XXI, p. 9, of the present work. I am of opinion that it is worthy of specific rank.

RANGE.

It appears to be confined to New England, New South Wales, and the extension of that elevated tableland into Southern Queensland.

For a number of localities, with notes, see this work Part XXI, p. 10. The following are additions (New South Wales) :—

Belltrees, near Scone (L. A. Macqueen).

"Peppermint," coarse fibrous bark. Uralla (Dr. J. B. Cleland). Armidale, not rare, especially on Uralla-road (J.H.M.).

Bark rough, fibrous to scaly, with clean tips of branches. Trees varying in size. Very common all over the district, more especially on the flats at the foot of the Peak, Chandler's Peak, near Guyra (J. L. Boorman).

Bald Knob, 16 miles on the Glen Innes-Grafton road. (H. T. Paton.)

"Tree of 20–30 feet, fairly common. Much branched and pendulous in habit, the bark fibrous and somewhat flaky, branches of a dirty white to reddish. Usually on flats, with moisture and good soil. Timber comparatively useless; used for firing when dry, but it rarely grows of sufficient size to be milled." Wallangarra (J. L. Boorman).

AFFINITY.

1. With *E. cinerea* F.v.M.

But *E. nova-anglica* has—

(*a*) Flowers in more than threes;

(*b*) Mature leaves always lanceolate, *i.e.*, it never flowers in the broad-leaved stage;

(*c*) The peduncles are usually not in pairs in the axils as in the normal form (and in var. *multiflora*).

E. cinerea has a reddish timber, of very little value, and a reddish fibrous, friable bark, whilst *E. nova-anglica* has a paler-coloured timber and a more flaky bark.

The seedlings of the two species are much alike.

THE GROWING TREE.

A.—Rate of Growth.

Following are some references to the scanty Australian literature on the subject:—

"Age of Australian (Tasmanian) Trees." J. E. Tenison-Woods, in *Journ. Roy. Soc. N.S.W.*, xii, 21 (1878).

"Rate of Growth of Trees" ("The Eucalypts of Gippsland"), Howitt, in *Trans. Roy. Soc. Vict.*, ii, 111 (1890).

"Notes on the Rate of Growth of some Australian Trees." H. C. Russell, in *Journ. Roy. Soc. N.S.W.*, xxv, 168 (1891). The observations were taken at Lake George, and at the Sydney Observatory.

"Rate of Growth of Native and Other Trees." In the Presidential Address of Henry Deane, *Proc. Linn. Soc. N.S.W.*, xx, 633-636 (1895), will be found some valuable information on the subject.

See also a paper, "Rate of growth of Indigenous Forest-trees," compiled by me from the reports of Foresters, in the *Agric. Gaz. N.S.W.*, August, 1893, which contains much useful information, some of which I have abstracted below.

Bull., No. 8, Department of Forestry, New South Wales (April, 1914), is a leaflet entitled "Rate of Growth of Indigenous Commercial Trees," but they are taken in groups, "Coastal Hardwoods" and "Inland Hardwoods," and the species are referred to only by vernaculars.

Reference may also be made to the article in my "Forest Flora of New South Wales," Part 68, which gives some data in regard to the growth of various species in non-Australian countries.

In giving numbers of years of growth of a tree, much depends on the dates in order that we may ascertain the meteorological conditions. As a rule authors omit the dates, and hence we are dealing with indefinite growing entities, which we cannot check. For example, the rate of growth of a tree between the years 1890 and 1900 may be very different to the growth between the years 1895 and 1905, or 1900 and 1910.

With reference to the following brief papers of Rev. J. E. Tenison-Woods and Mr. (afterwards Dr.) Howitt, admirable observers, which tend to show that large trees have probably not the great ages attributed to them by bush people and others, it is interesting to note that expert foresters have, during the last few years, in Europe and elsewhere, thrown doubt on the ages of many trees deemed by tradition, more or less authentic, to be "historic." It has been pointed out in some cases that trees in a forest die from natural causes or accident, and are succeeded by seedlings of their

own kind which absorb the traditions of a line of ancestors, perhaps remote. We are familiar with statements as to the tree of Robin Hood, and other persons more or less mythical, and even historic; as to " the oldest tree in the world " (attributed to a certain specimen of *Dracaena Draco* in Teneriffe), and so on.

" It is a very interesting inquiry to know how old are the stately trees which people these (Southern Tasmania, J.H.M.) forests. Judging from their size, one would be inclined to attribute to them great antiquity. I was very anxious to collect data on the subject; but to nearly all my inquiries I only received mere guesses; from 200 to 300 years was the general reply. I found, however, in Mr. Hill a source of information at once reliable and valuable. Mr. R. Hill is the proprietor of an extensive sawmill at Honeywood, on the Huon; he is also a ship-builder and hop-grower. It is from him that I have derived the most of the statistical information in the paper, and the facts which did not come under my personal observation; and I take this opportunity of thanking him for his readiness in affording every aid to inquiry, and express the hope that the colony may long profit by his intelligence, industry and enterprise. Mr. Hill assured me that some of the Gum trees, and perhaps all of them, shed their bark twice in the year. The Stringybark (*E. obliqua*) is one of the most striking instances of this. He further informed me that, hearing a lecture from Mr. Bicheno on the growth of trees, and the statement that a ring of wood was added to the diameter each year of growth, he was induced to test the truth of this. There was a Blue Gum (*E. globulus*, J.H.M.) in his garden in Hobart Town, the age of which he was sure of, as his brother had planted it eighteen years previously. He felled it and counted the rings, and found them to be thirty-six in number, or two for every year. From this, and from the shedding of the bark as described, and a long series of observations, he concludes that the sap rises twice in the year. He has for many years watched the growth of the trees, and he believes that for the first twenty years the average growth is about 1 inch in diameter for each year. Out of thousands of trees felled, or cut in his mill, he has not found one over 75 years old, and a very large proportion of the serviceable timber is composed of trees about 50 years of age. Quite recently he has had a very interesting opportunity of verifying these observations. At Ladies' Bay (between Port Esperance and Southport), a paddock on the farm of Mr. D. Rafton was cleared for the purposes of cultivation. It was exactly sixteen years this summer (1877–78) since a crop was taken off it, and was quite overgrown with saplings, which were all cut down. Mr. Hill, at my request, wrote to Mr. Rafton, requesting him to examine the stumps, and I append his reply :—' Ladies' Bay, 26th April, 1878. According to your request I send you the result of my examination of the stumps of young saplings in the paddock which we are now clearing. Number of rings in the longest saplings, thirty-three; size across the heart-wood where the rings cease, 1 inch. The rings, I observe, are not an equal distance from each other, some of them being three times the size of the others. On making inquiries I find beyond a doubt that it is exactly sixteen years this summer since the last crop was taken off the paddock. Yours truly, D. Rafton.' From these facts I think we may safely adopt Mr. Hill's conclusion that there are two rings of growth for each year, and that the tallest trees of the forest, the giant timber of Tasmania, range from 50 to 75 years old." (Tenison-Woods, *loc. cit.*)

Now we come to Howitt, who is speaking of Gippsland :—

The age of the new forest does not, however, depend merely on the general observation that they have sprung up since the settlement of the country in 1840.

I have been enabled to make some direct observations, which show the size of certain trees of known age, and which will serve as comparison for the general growth of the forests.

In 1864 the discovery of auriferous quartz reefs in the Crooked River district, caused a township, which is now called Grant, to be formed on the summit of the mountains, near the source of the Good Luck Creek. In part of the Government reserve, upon which the Warden's quarters and police camp stood, and which was cleared of timber, a few young *E. amygdalina* (*E. radiata* is meant, J.H.M.) trees grew, and were permitted to remain. One of these was lately kindly measured for me by Mr. W. H. Morgan, M.M.B., who found it to be 56 feet high and 10 feet in girth three feet above the ground. This tree is an example of very many others of the same species now growing on the surrounding ranges. At Omeo, in the Government reserve, a number of young *E. viminalis* are now 60 feet high, which in 1863 were only small saplings under 5 feet in height. On the road from Sale to Port Albert, which was formed somewhere about

1858-59, there are numerous places where *E. viminalis* and *E. Muelleriana* and other species are now growing upon the ditches formed at the sides of the road. Those, for instance, at Lillies Leaf are on the average about 30 feet high.

These instances show how the occupation of Gippsland by the white man has absolutely caused an increased growth of the Eucalyptus forests in places. I venture, indeed, to say with a feeling of certainty produced by long observation, that, taking Gippsland as a whole, from the Great Dividing Range to the sea, and from the boundary of Westernport to that of New South Wales, that, in spite of the clearings which have been made by selectors and others, and in spite of the destruction of Eucalypts by other means (to which I am about to refer), the forests are now more widely extended and more dense than they were when Angus M'Millan first descended from the Omeo plateau into the low country." (Howitt, *loc. cit.*)

Following are some notes on the rate of growth of individual species of trees, arranged in alphabetical order. The notes are so few that the new Forest Controllers of the various States have practically to begin records for themselves. All these are New South Wales records, unless otherwise indicated :—

E. cladocalyx F.v.M.—A tree at Balwyn, near Melbourne, in eleven years and two months attained a height of 53 feet, with a circumference at ground of 43½ inches, at 6 feet, 41 inches. F. Chapman, A.L.S., in *Vict. Nat.*, 7th November, 1918, p. 106.

E. diversicolor F.v.M.—A.B., of Torbay Junction, writes the following concerning rate of growth of trees in Western Australia, in the *Western Mail* of 26th September, 1913 :—

Re age of Karri trees, I note your remark that to find the age of Karri trees you count the number of rings from the centre to the bark. This method is not correct for the majority of native trees of Australia. Many years ago in Gippsland a deal of discussion took place on this subject. The theory that is held by botanists was believed until it was proved by actual fact to be incorrect. I have seen myself White Gum saplings grown in five years—from where a sawmill was in actual work—cut down, and the rings counted from twelve to sixteen in each sapling. (These observations confirm those of Tenison-Woods, already cited. J.H.M.). These saplings grew up in the trolly track the benchmen were walking in five years before, and were from 4 to 8 inches each in diameter. Numerous others found similar cases. Mr. Chris. Mudd, F.L.S., a botanist, visited Gippsland district some little time after. On the fallacy being pointed out to him, he then expressed the opinion that the rings indicated growths, and not years. It is evident this is so, and also that different species of trees have a different number of growths in the year, some only one and some as many as three. The climate also, in the botanists opinion, made the difference. That Karri trees in this district make more than one ring in a year—while they are saplings at least—I am certain, having tested it. The exact number they do make would, however, take a bit of careful investigation, which could perhaps be best found out by some older settler who knew of a tree planted, say thirty or forty years ago.

E. globulus Labill.—

Two trees were planted at the same time on the south side of the Observatory Reserve, in trenched and manured ground. The larger of these trees, that at the south-west corner of the ground, measures 3 ft. 10 in. round 3 feet above the ground. The other one near the cottage measures 3 ft. 5½ in.; they were small pot plants when put in and would now be 16 years old. They do not seem to be growing vigorously, perhaps this is not to be wondered at as the roots cannot penetrate the solid sandstone which is close to the surface where they grow.

The tree in Observatory Park is now 16 years old and is 3 ft. 10 in. round, 3 feet above the ground, or 6½ inches less than the tree at Lake George, which is a year younger. The trees on Mount Victoria measured about 63 inches round after fifty years' growth, and the measures on the Lake George tree (believed to be *E. viminalis*) seem to justify us in assuming that it enlarged uniformly year after year. Therefore, at fifteen years, the Observatory Park (Sydney) tree measured 43 inches. (Russell, *loc. cit.*)

E. maculata Hook.—Trees with height 60 feet, diameter 24 inches, acquired this in twenty years, and others with height 40 feet acquired a diameter of 10 inches in ten years. They grow on the south coast of New South Wales (Forester J. S. Allan). A spotted Gum in the Shoalhaven district, New South Wales, in an old saw-pit not used for seventeen years, was then 2 feet in diameter by 25 feet to first limb, and 45 feet high; good soil, side of hill. (Forester G. R. Brown).

In Annual Report of the Forestry Commission (up to 30th June, 1919), p. 27, is a note on experiments in coppicing *E. maculata* and *E. pilularis* for about two and a half years near Wyong, New South Wales.

E. paniculata Sm.—A tree aged 10 years acquired a height of 40 feet, diameter 10 inches. South Coast (Forester J. S. Allan).

E. pilularis Sm.—A self-sown seedling was measured at Gosford in 1889, on the land which was cleared for a nursery site. In eighteen months it had attained a height of 25 feet, and a circumference of 18 inches. (John McCoig.) In ten years, on the South Coast, a tree acquired a height of 40 feet, diameter 10 inches (Forester J. S. Allan). At Cogo, Wilson's River, in the old vineyard (twenty-five years neglected), are now growing Blackbutts, average 18 inches in diameter, 25 feet to first branch, and 50 feet high. (Forester G. R. Brown, 1895.) A Blackbutt sapling seventeen years ago 12 inches in diameter and 30 feet high, is now (1895) 2 feet 9 inches in diameter, and 40 feet to first limb, 70 feet high. (Forester G. R. Brown, Port Macquarie.)

In January, 1885, I measured certain Blackbutt saplings in the parish of Clybucca, county of Dudley. These saplings were then about 5 years old, and taped about 12 inches girth by a height of 10 feet from the measurements then taken. I find that the same saplings now (1895) average 36 inches girth and a height of 40 feet. (Forester McDonald, Kempsey.)

In Annual Report, Forestry Commission (up to 30th June, 1919), p. 27, is a note on the regrowth in three years of two species (*E. propinqua* and *E. saligna*), on land burnt over in the Wyong district, New South Wales.

E. radiata Sieb. (under *E. amygdalina* Labill). See Mueller's "Eucalyptographia."

E. rostrata Schlecht.—

In suitable localities I estimate that the Murray River Red Gum attains a height of about 50 to 60 feet in ten years, after which it does not grow so rapidly. It will attain a diameter of about 12 inches in twelve years, then I estimate it increases at the rate of about ¾ inch in a year until it gets to about 24 to 26 inches in diameter. (Inspecting Forester Manton, 1895.)

E. saligna Sm.—

About nine years ago land was cleared at Hogan's Brush, near Gosford. After the clearing, a Blue Gum came up and was suffered to remain. Now it is 50 feet in height, and circumference of 3 feet 6 inches at 4 feet from ground. Measured October, 1895. (Forester John Martin.)

A Blue Gum five years ago was 3 inches in diameter and 15 feet high. It is now (1895) 12 inches in diameter by 15 feet to first limb, and 35 feet high; red second-class soil, in the open. (Forester G. R. Brown, Port Macquarie.)

E. viminalis Labill.—

The young tree that I selected in January, 1885, was one of a cluster of four, close to the jetty (Lake George) on which the lake gauge is placed, and it was found to measure 23 inches round, 3 feet from the ground; it was measured again on the 10th November, 1891, and found to be at 3 feet from the ground 52¼ inches round, almost exactly 17 inches in diameter, that is, an increase from 7 to 17 inches in diameter in six years and eight months, a rate of increase which, if maintained for five years more, would make it a large tree upwards of 2 feet in diameter and only 20 years old.

As to the age of the tree measured at Lake George, it was growing about 4½ or 5 feet within the high-water mark of the great flood of 1874, within which all the trees were killed, the residents when appealed to, said the four trees could not be more than seven or eight years old, which agrees with probabilities as to their age, for they would not spring up until a year or two after the water retired, and it did not leave the spot they grew on until 1875, ten years before I was there. Taking then eight years as their probable age in February, 1885, they would now be almost 15 years old, and the tree measured is now 4 feet 4¼ inches round, 3 feet above the ground. Therefore at fifteen years the Lake George tree measured 52¼ inches. The probable age at this measure was fourteen years eight and a half months; if allowance for three and a half months is made to bring the age up to fifteen full years, it would measure 53¾ inches round; on 22nd November, 1892, girth 54¼ inches; 1st January, 1894, girth 60¼ inches; January, 1895, girth 63¼ inches. (Russell, *loc. cit.*)

Following is a report on some Victorian *viminalis* trees:—

Seed sown January, 1912; seedling planted out August, 1912. In December, 1916, this became 25 feet high, and 9 inches in diameter. First sign of flower-buds November, 1915. Flowers annually in November; shed its bark for first time in December, 1916. In full bloom 25th January, 1917. (P. R. H. St. John, in *Vict. Nat.*, February, 1917, p. 155.)

B.—Natural Afforestation.

Following is a valuable contribution to the question of the influence of settlement on Eucalyptus Forests, by the late Dr. A. W. Howitt:—

The influence of settlement upon the Eucalyptus forests has not been confined to the settlements upon lands devoted now to agriculture or pasturage, or by the earlier occupation by a mining population. It dates from the very day when the first hardy pioneers drove their flocks and herds down the mountains from New South Wales into the rich pastures of Gippsland.

Before this time the graminivorous marsupials had been so few in comparative number that they could not materially affect the annual crop of grass which covered the country, and which was more or less burnt off by the aborigines, either accidentally or intentionally, when travelling, or for the purpose of hunting game.

Annual Bush Fires.—These annual bush fires tended to keep the forests open, and to prevent the open country from being overgrown, for they not only consumed much of the standing or fallen timber, but in a great measure destroyed the seedlings which had sprung up since former conflagrations. The influence of these bush fires acted, however, in another direction, namely, as a check upon insect life, destroying, among others, those insects which prey upon the Eucalypts.

Granted these premises, it is easy to conclude that any cause which would lessen the force of the annual bush fires would very materially alter the balance of nature, and thus produce new and unexpected results.

The increasing number of sheep and cattle in Gippsland, and the extended settlement of the district, lessened the annual crop of grass, and it was to the interest of the settlers to lessen and keep within bounds bush fires which might otherwise be very destructive to their improvements.

The results were twofold. Young seedlings had now a chance of life, and a severe check was removed from insect pests. The consequence of these and other co-operating causes may be traced throughout the district, and a few instances will illustrate my meaning.

The valley of the Snowy River, when the early settlers came down from the Maneroo (Monaro) to occupy it, as, for instance, from Willis downwards to Mountain Creek, was very open and free from forests. At Turnback and the Black Mountain, the mountains on the western side of the river were, in many parts clothed with grass, and with but a few large scattered trees of *E. hemiphloia*.

Forests increased.—The immediate valley was a series of grassy alluvial flats, through which the river meandered. After some years of occupation, whole tracts of country became covered with forests of young saplings of *E. hemiphloia*, *pauciflora* (*coriacea*), *viminalis*, *amygdalina* (*radiata*), and *stellulata*, and at the present time these have so much increased, and grown so much, that it is difficult to ride over parts which one can see by the few scattered old giants were at one time open grassy country.

Within the last twenty-five years many parts of the Tambo Valley, from Ensay up to Tongio, have likewise become overgrown by a young forest, principally of *E. hemiphloia* and *macrorrhyncha*, which extend up the mountains on either side of the valley. This dates especially from the time when the country was fenced into large sheep paddocks, when it became very important that bush fires should be prevented as a source of danger to the fences, and even when fire occurred the shortness of the pasturage checked the spread.

Similar observations may be made in the Omeo district, namely, that young forests of various kinds of Eucalypts are growing where a quarter of a century ago the hills were open and park-like. In the mountains, from Mount Wellington to Castle Hill, in which the sources of the Avon River take rise, the increase of the Eucalyptus forests has been very marked. Since the settlement of the country, ranges, which were then only covered by an open forest, are now grown up with saplings of *E. obliqua*, *E. Sieberiana* and others, as well as dense growths of *Acacia discolor*, *A. verniciflua*, and other arborescent shrubs. These mountains were, as a whole, according to accounts given me by surviving aborigines, much more open than they are now.

In the upper valley of the Moroka River, which takes its rise at Mount Wellington, I have noticed that the forests are encroaching very greatly upon such open plains as occur in the valley. I observed one range, upon which stood scattered gigantic trees of *E. Sieberiana*, now all dead, while a forest of young trees of the same species, all of the same approximate age, which may probably be twelve years, growing so densely that it would not be easy to force a passage through on horseback. Again, at the Caledonia River, as at the Moroka, the ranges are in many parts quite overgrown with forests not more than twenty years old. The valleys of the Wellington and Macalister Rivers also afford most instructive examples of the manner in which the Eucalyptus forests have increased in the mountains of Gippsland since the country was settled. The forest in these valleys, below 2,000 feet above sea level, is principally composed of *Eucalyptus polyanthemos*, *E. macrorrhyncha*, with occasional examples of *E. melliodora* and *E. Stuartiana*; while *E. viminalis* occupies the river banks and moist flats. I noticed here that *E. melliodora* and *E. macrorrhyncha* formed dense forests of young trees, apparently not more than 25 years old. In some places, moreover, one could see that the original forest had been composed, on the lower undulating hills and higher flats, of a few very large *E. melliodora*, with scattered trees of *E. polyanthemos* and *E. macrorrhyncha*. At the present time the two latter have taken possession, almost to the exclusion of *E. melliodora*. In other places *E. polyanthemos* or *E. macrorrhyncha* predominate; but, on the whole, I think the latter will ultimately triumph over its rivals, unless the hand of man again intervenes.

Such observations may also be made in Western and Southern Gippsland, but, of course, with reference to different species of Eucalypts.

In the great forest of South Gippsland many places can be seen where there are substantially only two existing generations of trees; one of a few very large old trees, the others of very numerous trees which are probably not older than thirty to forty years, and in most cases certainly not half that period. The older trees of this second growth do not, I suspect, date further back than the memorable "Black Thursday" (6th February, 1851.—J.H.M.), when tremendous fires raged over this tract of country. It may also be inferred, from the constant discoveries, during the process of clearing, of blackfellows' stone tomahawks, that much of this country now covered by a dense scrub of gum saplings, *Pomaderris apetala* *Aster argyrophylla*, and other arborescent shrubs, was at that time mainly an open forest.

I might go on giving many more instances of this growth of the Eucalyptus forests within the last quarter of a century, but those I have given will serve to show how widespread this re-foresting of the country has been since the time when the white man appeared in Gippsland, and dispossessed the aboriginal occupiers, or to whom we owe more than is generally surmised for having unintentionally prepared it, by their annual burnings, for our occupation. (A. H. Howitt in *Trans. Roy. Soc. Vict.*, ii, 109, 1890.)

The following is based on what I wrote in the *Agric. Gazette, N.S.W.*, vol. vi, 593 (1895), and also issue for April, 1905 :—

The Spontaneous Growth of Trees.—Natural regeneration or re-afforestation is proceeding often without our knowledge, and even in spite of ourselves—quietly, surely.

I was informed here (Failford) and also on the A. A. Company's Estate (Gloucester) that formerly the hills were often destitute of timber where now there is dense forest. The reason of this change is attributed to the over-stocking of the country, the stock eating down the grass so that bush fires (which formerly consumed the seedlings of forest trees) are now less frequent, and devastate smaller areas than they used to do. . . . Mr. Forester Rudder expresses the opinion that cattle directly aid the propagation of trees by trampling the seeds into the ground.

In Australia and Tasmania the following experience is not uncommon. When sheep are folded the manure becomes quite thick. In a few years, if the sheep be removed, Eucalypts come up freely. This occurs in places in which they were not previously found. It seems to me that this points to the sheep licking up the seed with their feed and redepositing it in manure. Vigorous growth would take place in fertilised soil. Perhaps this matter of natural afforestation (not re-afforestation, as it takes place in areas not previously known to carry trees) may be entirely explained by herbivora grazing in forest land and depositing their dung on non-forest land. The obvious reason why this afforestation does not take place more abundantly, is because sheep and cattle readily eat down young seedlings, which must therefore be protected accidentally or otherwise in order that they may reach maturity.

See also the extract from Dr. Howitt's paper just quoted.

This natural spread of forests should be comfort to those who are apt only to consider the destructive action of the timber-getter, and to lose sight of the compensating influences that are at work.

The springing up of young forest growths where there was formerly forest is, of course, common enough. We do not know how long many seeds will remain dormant in or on the ground after the old growth has been removed. It is not an uncommon thing to see a straight avenue of trees not artificially planted. One fine avenue known to me is along the line of an old chock and log fence, and consists of She-Oaks (*Casuarina*)*. Oak saplings were used as top-rails for this fence, the seed from the saplings germinated, and the young growth was protected from stock by the fence. The seedlings grew into fine trees, and finally the old fence was removed, leaving only the line of trees which followed the direction of the fence. I have seen a similar occurrence with the Grey Box (*Eucalyptus hemiphloia*) in the Bringelly, N.S.W., district.

C.—Increment Curves.

There would appear to have only been published, as regards botanically identified trees, data concerning very few species.

Determination of Increment by Stem Analysis.—The scientific forester requires more than the empirical data of rate of growth to which I have already referred. He requires a proper record of growth or increment ascertained by scientific methods.

* *E.g.*, *Agricultural Gazette*, vii, 514.

The Forestry Commission of New South Wales has issued, August, 1918 (the researches were made in 1916), Bulletin No. 13, under the above title, compiled from data supplied by W. A. W. de Beuzeville, Forest Assessor, of which a brief abstract is sufficient for the present purpose.

The determination of the rate of growth of trees and forests is of fundamental importance to the forester, because, without accurate knowledge of this subject, he is unable to fix the annual yield of the forest at that quantity which will ensure that the forest be not over-cut and the forest capital exhausted. The large number of forests throughout the State, which have been operated upon to such an extent that supplies of milling timber are now no longer available, is sufficient evidence of the disastrous result of over-cutting, and the necessity of ascertaining rates of growth and regulating the annual cut accordingly.

Rate of growth may be ascertained either by systematic measurement of standing trees in all stages of growth over a considerable number of years, or by making what is known as stem analyses of felled trees. Stem analysis can be applied only to those species the timber of which shows well-defined annual rings of growth, and for this reason, unfortunately, is inapplicable to the great majority of Australian species. Where possible, however, the method should be used, as it enables the forester to obtain valuable data upon which to regulate cutting operations while waiting for the more accurate information secured from the direct measurement of growing trees.

It should be remembered, however, that the rates of growth ascertained by stem analysis of trees in virgin forests do not necessarily represent the rates which will be obtained in the future under careful forest management. The forest trees from which the selection must be made have attained to maturity only after a long struggle against the competition of their rivals, and without the aid of the forester, who by well-regulated thinnings, can do much to accelerate the rate of growth. Consequently the figures obtained from stem analysis should be regarded rather as the safe minimum to be expected in the future.

For the purpose of obtaining authentic information relative to the growth of species of Eucalyptus on the southern tableland, Mr. Forest Assessor W. A. W. de Beuzeville made stem analysis of the Buddong Mountain Ash (*E. gigantea* Hook).

The figures and conclusions arrived at for the Mountain Ash are given in full in the Bulletin, as it is reported to be the fastest growing species in New South Wales.

The specimen selected for investigation was a typical forest tree, well grown and carrying a heavy crown occupying little more than half the total height of the tree. It was felled at ground level, and the main stem marked off into nine pieces, each of which was cut through the centre. The concentric rings on each section were counted, and the diameters measured, the information being then tabulated, and the calculations made on the assumption that the concentric rings were annual.* (The method followed is that described in Chapter VI of vol. iii of Schlich's "Manual of Forestry," to which readers are referred.)

Details of the Analysis.

Section	1	taken at the foot of the tree			showed	97	rings.	
,,	2	,,	5	feet above ground level	,,	97	,,	
,,	3	,,	15	,, ,,	,,	95	,,	
,,	4	,,	25	,, ,,	,,	93	,,	
,,	5	,,	35	,, ,,	,,	91	,,	
,,	6	,,	45	,, ,,	,,	88	,,	
,,	7	,,	55	,, ,,	,,	85	,,	
,,	8	,,	65	,, ,,	,,	79	,,	
,,	9	,,	105	,, ,,	,,	53	,,	

Top, 35 feet long; total height, 140 feet; age, 97 years.

* If the rings are seasonal instead of annual, and it may be that two rings per year are formed, it will be seen that the growth of the trees was extraordinarily fast. This will not, however, affect the underlying principle which this bulletin is intended to explain.

Thus, at 35 feet from the ground there were only 91 annual rings as against 97 at the base. This means that the part of the tree above 35 feet had been in existence only ninety-one years, so that it took 97–91 = 6 years, for the tree to reach a height of 35 feet. Thus the following table is prepared .—

Height of section in feet.	Number of rings.	Number of years taken to reach height of section.
0	97	...
5	97	...
15	95	2
25	93	4
35	91	6
45	88	9
55	85	12
65	79	18
95	53	44
140	0	97

From this table a curve showing height at different ages is plotted (see Fig. 1, not reproduced, J.H.M.). The very rapid height growth in the first twelve years should be noted as it has an important economic bearing on the regeneration of the forests. A species capable of such rapid growth in early youth is not likely to be suppressed by weeds, and consequently expenditure on early cleanings will probably not be necessary. Compare the figures for *E. globulus*, in Tasmania, quoted at p. 245.

A further abstract of Mr. de Beuzeville's researches is found in " The Australian Forestry Journal," for January, 1918.

' The forest of *E. gigantea* at Buddong appears to be of comparatively recent origin, and is rapidly establishing itself in the surrounding forest of *Eucalyptus coriacea* and *E. rubida*. A noteworthy feature is that trees evidently well past maturity are sound to the heart and absolutely free from disease.

The specimen selected for analysis was a typical tree of a typical forest of the species. The annual rings were clearly defined through the whole of the cross sections, and varied very little in width. The tree was well grown, with a good crown, and apparently still vigorous.

A remarkable circumstance was the rapid height growth during the early life of the tree, and this is shown in a series of graphs which accompany the treatise, and disclose the following .—

Growth in height .—2½ years, 20 feet; 6 years, 40 feet; 14 years, 60 feet; 20 years, 68 feet; 40 years, 90 feet; 60 years, 110 feet; 80 years, 126 feet; 96 years, 140 feet.

Growth in diameter .—2 years, 1 inch; 6 years, 2½ inches; 14 years, 6 inches; 20 years, 9 inches; 40 years, 18 inches; 60 years, 28 inches; 80 years, 36 years; 96 years, 42 inches.

Volume of wood .—20 years, 20 cubic feet; 40 years, 75 cubic feet; 60 years, 180 cubic feet; 80 years, 300 cubic feet; 96 years, feet 420 cubic feet.

Calculation on the results of an examination of the area of the cross section at various ages shows that the tree reaches absolute maturity about the ninetieth year, when it will yield almost 5,000 superficial feet of timber.

Mr. de Beuzeville states that the bark amounts to 12 per cent. of the volume of the stem, the very low percentage being accounted for by the thin nature of the bark on the upper portion of the trunk. In conclusion, he remarks that his analysis discloses that " the tree does not reach absolute maturity at the early age often attributed to it, but maintains a vigorous growth long after it has reached the dimensions of a millable log. The present minimum felling girth is 7 feet over bark, and is apparently reached in forty to fifty years. The problem is, therefore, whether if will be most advantageous to operate on the species as at present, or whether the cutting age should be deferred until maturity, when greater volume has been attained."

Then we come to a paper: "Determination of the Increment of Trees by Stem Analysis. No. 1. *Eucalyptus viminalis*," by W. A. W. de Beuzeville, *Journ. Roy. Soc. N.S.W.*, liii, 239 (1919). (N.B.—The species is really *E. Dalrympleana* Maiden, as described by me in "Forest Flora of New South Wales," Part LXIV, p. 137. It was formerly confused with *E. viminalis*.)

The calculations show that the tree increases in height rapidly until about thirty years old, averaging 2·8 feet per annum. This rate gradually diminishes, dropping to 1·6 feet mean annual increase when sixty-six years old. The diameter increase, likewise, is greater during youth, but is fairly evenly maintained during the whole period, ranging from ·37 inches to ·3 inches per annum. The mean annual volume increment, which was ·1 cubic feet at ten years, showing a steady improvement, reaching 1·13 cubic feet at sixty-six years of age.

Earlier in point of publication than the preceding papers, we have "Timber Production and Growth Curves in the Mountain Ash (*Eucalyptus regnans*)," by R. T. Patton, *Proc. Roy. Soc. Vict.*, xxx (N.S.), i (1917).

It is not convenient to reproduce the graphs of the papers of either Mr. Patton or Mr. de Beuzeville. All the papers should be carefully read, and I will content myself with a few extracts of Mr. Patton's paper also.

It has been said that Mountain Ash will mature in forty years, and will give in this time a butt of from 2 feet to 2 feet 6 inches. It has also been claimed for Mountain Ash that it is the fastest-growing tree in the world, and that it will give a cut of 150,000 feet super. per acre. In order to test the truth of these statements a series of measurements was carried out at Powelltown on logs of this timber.

It was found impossible at the time to get any reliable figures as to either its fast growing rate or its quantity of timber per acre. Many factors militated against this. In the first place, all the forest now being cut is over ripe, and consequently many trees are hollow. Again, a very large number of trees have incipient decay in the heart. Other factors also prevented any accurate estimate being formed. However, there was ample material for a study of the annual rings. It was impossible to obtain measurements from all logs coming in, as in quite a percentage there was either a pipe, or decay had proceeded far enough to destroy the boundaries of the first annual rings. Only those logs then were taken in on which the annual rings were clearly defined. The measurements were taken to the eightieth ring, and not continued further owing to the difficulty in many cases of distinguishing the rings. In one case the rings, though narrow, were easily distinguishable to the 125th ring. It was obvious from these later rings that the tree had lacked vigour. This was borne out by a study of the trees in the standing forest. The paucity of foliage on these big trees is very noticeable, as was also the amount of mistletoe. No mistletoe was observed on the saplings, or even on trees half grown. From these observations one was led to conclude that the tree reaches its prime well under a hundred years.

The most remarkable feature is the rapid expansion of the trunk (and hence width of annual ring), during the first ten years of growth. . . .

The differences between the width of the annual rings as the tree gets older will be less and less. There is a point of interest here, and that is that the enormous decrease in the width of the ring may be due to overcrowding, or putting it in other words, that, as the trees grow older, and so many are striving for the same light and carbon dioxide, the crown is not as large as it would be if the forest were controlled. It was very apparent from a study of the mature trees that width of ring is largely dependent on the distance of the trees apart, for in many logs the original centre is well to one side of the mature log. Some trees have limbs on the congested side only 6 to 8 feet long, while on the free side they are 15 to 20 feet long. The maintenance of a good head is important from a forestral point of view. . . .

From the study of the annual rings, then, we may conclude at present that the Mountain Ash reaches its maturity between the fortieth and fiftieth years; but we are not entitled to conclude that the tree is then fit for milling. In view of the fact that in the future a large proportion of this timber will probably find its way on to the market in a dressed and seasoned condition, the tree cannot be said to be fit for

milling until the wood is ripe. It may well be, that so long as the tree maintains a good head, the timber is improving in quality, and therefore it may be inadvisable to cut it during this period. There are other factors as well to be considered with regard to the time of harvesting the timber. The upkeep of this forest is small at present, as compared with that of the forests of the old world. Hence interest charges will be much smaller, and we could therefore allow the forest to stand for a much longer period than is the case with old world forests.

See also "On the Growth, Treatment, and Structure of some Common Hardwoods," by R. T. Patton, *Proc. Roy. Soc. Vict.*, xxi (New ser.), 394 (1919), with one plate and seven text figures.

The author systematises his observations under the following heads:—Height, density of trees per acre, seasoning of timber, structure. He criticises the adoption of the Schlich method of measurement of diameter growth (at all events, as regards Australian conditions) if only because, in our "empirical" or managed forests, it is difficult to select an average tree for research.

The question of the height of *E. regnans* (Victorian Mountain Ash), the only Eucalypt referred to, is dealt with at p. 255 of the present work. The question of density of trees per acre is only now being undertaken, since we have only quite recently established forestry departments taking cognisance of our Eucalypts on scientific lines.

As regards seasoning of timber, I will give a few references to this, and also to structure of timber, when I deal with those branches of the subject.

Now let us turn to a paper, "Estimation of the Rate of Growth of Trees by Stem Analysis," by C. E. Lane Poole, "Jarrah," i, No. 3, p. 14, November, 1918.

The author begins:—

"It is an unfortunate fact that the bulk of Australian eucalypts do not lend themselves to this system of estimation. There are exceptions, of which Mountain Ash (*Eucalyptus Delegatensis*) of New South Wales is one, but in most cases Eucalypts do not appear to have any distinct period of rest during the year, with the result that there are no well-defined rings. Karri (*E. diversicolor*) in its very early years (up to about twenty-four), shows annual rings, but after that time it is difficult to distinguish them."

He then gives an admirable account of the method, choosing the Monterey Pine (*Pinus radiata* or *insignis*), a Californian species much cultivated in Australia, for purposes of illustration.

D.—The Largest Australian Trees.

The size of a tree may be measured in vertical height or girth, the two dimensions usually adopted. The fairest method would, of course, be to compute the cubic contents. As regards girth, it is to be regretted that many measurements are not strictly comparable, because of the varying heights above ground at which they have been taken.

It has been known for many years that Australia and Tasmania possess very large trees, attention having been directed earliest to those of Tasmania. It has since been proved, I think, that the largest trees (*E. regnans*) occur in Gippsland, Victoria,

although those of the Western Australian Karri (*E. diversicolor*) are very large. Most of the literature has gathered around the Gippsland trees, and will be found quoted below by Mr. Hardy and myself.

A discussion on the height of Gippsland trees (Mr. Howitt's paper, in *Trans. Roy. Soc. Vict.*, ii (1890), in which Baron von Mueller and Mr. A. W. Howitt joined, will be found in *Journ. Roy. Soc. Vict.*, iii (new series), 124 (1890). Mr. Howitt had measured a tree of 350 feet, and Mueller stated that trees 400 feet high had existed. The discussion is well worth referring to.

In my "Forest Flora of New South Wales," Vol. II, pp. 161–165 (1905), I gave such evidence as was available to me in regard to "The giant trees of Australia." I wrote at p. 163 in the following words:—

> Professor Sargent is an eminent authority on the subject of which he treats, and in view of the actual measurements that he presents, viz., 340 feet in height for a Redwood (*Sequoia sempervirens*), and a girth round the trunk of 107 feet for its congener, the "Big Tree" (*S. Wellingtonia*), I am of opinion that, so far as our knowledge goes at present, California is the home both of the tallest and of the broadest trees in the world.

In the Federal Handbook published for the visit of the British Association in 1914, I wrote:—

> The official size of the tallest Gippsland tree is given as—height, 326 ft. 1 in.; girth, 25 ft. 7 in., measured 6 feet from the ground; locality, spur of Mount Baw Baw, 91 miles from Melbourne. This is enormous, but different from the alleged heights of from 400 to 525 feet foisted on Mueller, and which will probably not be eradicated from the newspapers for another generation.
>
> As regards the Californian trees brought into comparison . . . the difference (under 14 feet) against the Gippsland tree is not large, and it would not be surprising if additional investigations should cause this friendly competition between Australia and the United States to end differently.

Presently I will show that New Zealand is in this competition.

"A short account of the big trees of California," Bull. No. 28, United States Department of Agriculture, Division of Forestry (1900), gives a later account than that of C. S. Sargent.

In the "summary of facts" it is stated that "the dimensions of the Big Tree are unequalled." A number of dimensions of trees, living and dead, are quoted, but comparatively few with full particulars. Thus the height is given of many, the diameter at the ground of some, and at 6 feet above the ground of others. Many particulars are given in regard to them in the Bulletin, which is not easy of brief abstraction.

For particulars as to tall trees of Brazil, see Bates' "Naturalist on the Amazons" (Murray's Pop. Ed., 1910, pp. 29, 30).

In a paper "On the Ascent of Water in Trees" (*Phil. Trans. B.*, Vol. 199, 1905) Professor A. J. Ewart (of the University of Melbourne), has some remarks in regard to the reputed heights of the Gippsland trees, after referring to certain reputed measurements which have been repeated over again by authors copying one another, as "greatly exaggerated" and "considerably exaggerated," he concludes, "The tallest Australian tree, therefore, hitherto accurately measured, barely exceeds 300 feet, and it is possible that some of the records from other countries, notably America, may suffer a similar diminution when accurately tested."

Mr. R. T. Patton (*Proc. Roy. Soc. Vict.*, xxxi, 396, 1919) has some notes on the height of *E. regnans*. He gives 326 feet as the "greatest height recorded," and the two highest measurements as made by himself as 249 and 261 feet.

In *Trans. N.Z. Inst.*, xlvi, p. 9 (published 1914), is a paper by T. F. Cheeseman on "The Age and Growth of the Kauri (*Agathis australis*)," in which he refers to the sizes of other large trees. He says: "Seeing that the age and size of large forest trees have been regularly overestimated in other countries, it could hardly be expected that New Zealand would escape similar exaggeration." He has just been quoting Professor A. J. Ewart's cautious remarks on Gippsland trees at some length.

Incidentally, it may be mentioned that in the American "Journal of Forestry," xvii, 890 (November, 1919), there is a note on Kauris and Californian Big Trees as follows:—

> The New Zealand Department of Lands has published a small book by D. E. Hutchins on the 'Waipoua Kauri Forest," in which occurs the statement.—"There were two gigantic Kauri in the Tutamoe State Forest, each having a diameter of 22 feet, and the best one having a clean bole of 100 feet. This was estimated to contain 295,788 board feet, which is twice the size of the largest California big tree, one of the Calaveras Grove, containing 141,000 board feet."
>
> The commentator says:—"It is strange that at the present day the claims of California for large sized trees should be contested by New Zealand. The following data show that even though New Zealand has some immense trees, as those just described appear to be, still they cannot equal the giant Sequoias, of which we are justly proud.
>
> "A Sequoia tree cut in 1854, called 'the Mother of the Forest,' had a diameter of 30 feet and a height of 321 feet, and contained 537,000 board feet, which is twice that given for these famous Kauri trees of New Zealand. In addition, this tree was 137 feet to the first limb. Another tree, called 'The Father of the Forest,' measured a number of years ago 36 feet in diameter, 400 feet in height, and 200 feet to the first limb." (These seem round numbers. J.H.M.)

Mr. D. E. Hutchins, "A Discussion of Australian Forestry," pp. 315–17 (1916), says:—

> I am sure that every patriotic Australian will agree that an attempt should be made by the Forest Departments in Victoria and Western Australia to find out the actually biggest trees, measure them, and place them under special protection.

I quite agree with this, and he is unconsciously repeating a very old suggestion of mine, but Mr. Hutchins says: "(Mr. Maiden) perhaps goes to the other extreme, and throws doubt on quite good evidence." If my readers will take the trouble to turn to what I have said, and also to what Mr. Hutchins has said, they can judge for themselves. If I have tried to avoid anything, it is to be "extreme," and my article was an honest attempt to weigh the evidence on scientific (*i.e.*, truthful) lines. The genial forester, when he has opportunity to consult the literature of the subject, will see that I am by no means the severest critic of reputed measurements of big Australian and American trees. [I wrote the above some years ago, before our friend had received the well-deserved honour of Knighthood, to be followed, alas too soon, by his death in January, 1920.]

The most recent writer on the subject is A. D. Hardy, of the State Forest Department of Victoria (" The Tall Trees of Australia," *Vict. Nat.*, xxxv, 46, July, 1918), an authority whose researches in regard to Australian forestry matters are always valuable, and, therefore, one reads what he has to say with interest in regard to a subject which has already been surrounded by much romance. This romance, emanating from Australia itself, has found its way into scientific publications in Europe and America.

The paper contains some most useful information in regard to the giant trees of America, and, indeed, of other countries, but what is of special interest to me at the present time is the information he has brought together, additional to that already compiled by myself. At p. 50 Mr. Hardy quotes three measurements which exceed those enumerated in the Victorian atlas of giant trees. The following is the " best measurement by a legally qualified measurer." Mr. G. Cornthwaite measured a tree in 1880, 2 miles from Thorpdale, Gippsland. " I cannot find the old notes taken at the time, but I am quite sure as to the measurement of the length." He gives the height at 375 feet, allowing for the stump. " At about 12 feet from the ground (it) was about 6 feet in diameter."

Although these figures are to some extent based on memory, if they satisfy Mr. Hardy they go a long way towards satisfying me.

Mr. Hardy quotes some American *Sequoias*, larger than the Redwood (*S. sempervirens*) measured by Professor C. S. Sargent, at 340 feet. Doubtless after the war (written in 1918, J.H.M.) the Americans will examine their records of measurements and state whether they can beat our record of 375 feet or not.

As regards bulk, Mr. Hardy quotes the tree pictured as " King Edward VII " by Mr. Hugh Mackay, Conservator of Forests of Victoria, in the handbook of that State prepared for the British Association meeting of 1914. It had a girth of 80 feet, measured at about 10 feet from the ground.

I have often pointed out (*e.g.*, Presidential Address, Royal Society of N.S.W., 1897), that it is desirable that we should have measurements by surveyors or other competent observers of the heights and girths of definite Eucalyptus trees, and the ascertainment of such data should be the business of the forestry staffs of all the States. We ought to know the sizes of our primeval vegetation, even if these biggest trees, when removed by fire or other catastrophe, may never be succeeded by others which can be permitted to attain equal magnitude.

Instead of going further into details in regard to the sizes of the largest trees, it may be convenient to consult the following list of species, arranged in alphabetical order, in which the sizes are dealt with. Thus the following may be referred to in their proper places in the present work, and in my " Forest Flora of New South Wales " :—

Eucalyptus Andrewsi Maiden, *E. botryoides* Sm. (H. Hopkins records *E. botryoides* in the rich alluvial flats of the Snowy River, stately trees of 150 feet or more in height, and boles of 6 or 7 feet in diameter, and 50 or 60 feet to the first limb), *E. Dalrympleana*

Maiden, *E. Deanei* Maiden (Mr. A. Murphy informs me that there are plenty of trees in the Ourimbah district, near Gosford, 10 to 12 feet in diameter), *E. Dunnii* Maiden (see note below), *E. diversicolor* F.v.M. (see this work, Part XX, p. 298), *E. gigantea* Hook. f. (see note below), *E. Jacksoni* Maiden, *E. goniocalyx* F.v.M., *E. maculata* Hook., *E. microcorys* F.v.M., *E. nitens* Maiden, *E. pilularis* Sm. (see this work, Part L, p. 30), *E. regnans* F.v.M., *E. viminalis* Labill.

Under *E. viminalis*, Mueller ("Eucalyptographia") quotes a Victorian tree up to 320 feet, with a diameter of 17 feet.

Baker and Smith ("Research on the Eucalypts," p. 137) say this tree is "probably the largest of New South Wales Eucalypts." "This is perhaps the most widely-distributed species of the genus in these States, as well as probably the tallest, as trees measuring over 300 feet high frequently occur." (p. 138.)

In view of the fact that *E. Dalrympleana* has been "carved out" of *E. viminalis*, and of further investigations in regard to our White Gums, it is desirable that *E. viminalis* and its allies should be remeasured. *E. viminalis*, *sensu strictu*, is, however, undoubtedly a big tree.

E. Dunnii.—

"I measured one standing tree of the above, which gave a girth of 24 feet 4 inches, with a length of at least 30 feet; this works out 13,322½ feet superficial. The tree in question is fairly round and straight, and apparently sound. A few days later, "To-day I measured another tree. It was felled for sawmill purposes. It was perfectly sound, straight and round. This tree was cut into four logs 11 feet in length (each log), the butt log measured 13 feet in circumference and contained 4,500 super. feet. Royalty at 6d. (£1 2s. 6d.)." (William Dunn, Forest Guard, Acacia Creek, Macpherson Range, near Queensland border, September, 1905.)

E. gigantea.—I submit an interesting note based on observations made in Tasmania in the thirties, and which I submitted to Mr. Rodway, the Government Botanist of that State, who reports: "In the Richmond district there is much *E. obliqua* and *E. gigantea*. I have never seen the former of such gigantic proportions as cited, wherefore think reference was to latter. At the time this article was written, all the forms with rough bark were referred to *obliqua*, and those with smooth to *amygdalina*."

Following is the note:—

"Mr. Backhouse and my son, Dr. Joseph Hooker, have made MSS. remarks upon a great number of new species in Van Dieman's Land, and it is there that the trees are seen to attain the most gigantic size. Near Richmond, in Yorkshire, the former gentleman visited a place in the forest remarkable for an assemblage of gigantic "stringybarks," *Eucalyptus obliqua*? There, within a space of half a mile, he measured ten different trees from 30 to 55 feet in circumference at four feet from the ground; and some of these fine sound trees were upwards of 200 feet high. One prostrate tree was 35 feet in circumference at the base, 22 feet at 66 feet up, 19 feet at 110 feet up. There were two large branches at 120 feet, and the elevation of the tree, traceable by the branches on the ground, was 213 feet. 'We ascended this tree on an inclined plane formed by one of its limbs, and walked four abreast with ease upon its trunk! In its fall it had overturned another 168 feet high, which had brought up with its roots a ball of earth 20 feet across. It was so much imbedded in the earth that I could not get a string round it to measure its girth. On our return I measured two stringybarks, near the houses on the Hampshire Hills, that had been felled for splitting into rails, each 180 feet long. Near to them is a tree that has been felled, which is so large

that it could not be cut into lengths for splitting, and a shed has been erected against it, the tree serving for the back." Another tree, at Emu Bay, supposed to be 250 feet high, was 55½ feet round at 5 feet from the ground, and nearly 70 feet in circumference at the surface of the ground. " My companions spoke to each other, when at the opposite side of this tree to myself, and their voices sounded so distant that I concluded they had inadvertently left me, to see some other object, and immediately called to them. They in answer, remarked the distant sound of my voice, and enquired if I were behind the tree." (*Bot. Mag.*, vol. 69, t. 4036, 1843.)

Explanation of Plates (196-199).

PLATE 196.

E. paniculata Sm.

(See also Plate 57, Part XIII.)

1*a*. Juvenile leaf; 1*b*, juvenile leaf (slightly more advanced); 1*c*, twig showing mature leaves and buds; 1*d*, immature fruits, showing staminal rings; 1*e*, fruits. Asquith, near Hornsby, between Sydney and the Hawkesbury River (W. F. Blakely).

2*a*. Buds; 2*b*, anthers. On the main road, near Gordon Railway Station, North Shore Line, Sydney (W. F. Blakely).

3. Juvenile leaf, not in its earliest stage. Kedron, near Brisbane, Queensland (C. T. White).

4. Mature leaves and fruits. Mount Gravatt, near Brisbane (C. T. White).

5*a*. Mature leaf; 5*b*, buds; 5*c*, fresh anthers. From the same set of specimens, some of the dried anthers precisely match 2*b*. Waterworks-road, Brisbane (J. L. Boorman).

PLATE 197.

E. paniculata Sm.

(See also Plates 57, Part XIII, and 196.)

E. Fergusoni R. T. Baker.

1*a*. Mature leaf; 1*b*, mature leaf and immature buds; 1*c*, fruits, markedly ribbed. Bulladelah, N.S.W. (L. C. Maxwell). The type.

I match *E. Fergusoni* perfectly with specimens of *E. paniculata*. My attempts to separate them have been most painstaking.

E. Nanglei R. T. Baker.

2*a*. Juvenile leaf; 2*b*, mature leaf and immature buds; 2*c*, fruits. *E. Nanglei* has, like *E. paniculata*, the staminal ring, and in this respect shows some affinity to *E. melliodora A.* Cunn., *E. sideroxylon* A. Cunn. Morrissett, N.S.W. (C. F. Laseron). The type.

3*a*. Mature leaves and buds; 3*b*, mature leaf, buds and expanding flowers; 3*c*, anthers, different views. Lindfield and Nowra, a mixed parcel, as received from Mr. Baker. Lindfield is a railway station on the North Shore Line, near Sydney; Nowra is on the Shoalhaven River, about 94 miles south of Sydney. (R. T. Baker and L. G. Irby). Co-types.

I am not able to separate *E. Nanglei* from *E. Fergusoni*, nor either of them from *E. paniculata*.

PLATE 198.

E. decorticans sp. nov.

(Syn. *E. siderophloia* Benth., forma *decorticans* F. M. Bailey.)

1*a*, 1*b*, 1*c*, the three youngest leaves I can find. They show that the juvenile leaves are narrow and do not differ in venation from the mature leaves. 1*d*, mature leaves and buds; 1*e*, anthers, 1*f*, fruits (Eidsvold, Queensland (Dr. T. L. Bancroft). The type.

E. Culleni R. H. Cambage.

2*a*. Juvenile leaves; 2*b*, buds; 2*c*, front and back view of anther; 2*d*, mature leaves and fruits. Alma-den, North Queensland (R. H. Cambage, No. 3905). The type.

PLATE 199.

E. Beyeri R. T. Baker.

(See also figure 21, Plate 57, Part XIII, as *E. paniculata*.)

1*a*. Twig with buds; 1*b*, fruits. St. Mary's (about 30 miles west of Sydney). (R. T. Baker.) The type.

2*a*. Juvenile leaf; 2*b*, twig with buds and flowers; 2*c*, twig with fruits. About 1 mile south-east of Kingswood Station (close to St. Mary's) and ¼ mile from the Great Western road (W. F. Blakely and J. L. Boorman).

Figs. 3 and 4 I at present look upon as intermediate between *E. Beyeri* and *E. paniculata*. It will be observed that the leaves are broader and coarser than those of *E. Beyeri*, but the trees were high, and they appeared to be a second growth, abundant on the branches, and therefore perhaps abnormal. *E. Beyeri* requires further investigation both as regards its botanical characters and timber.

3*a*. Mature leaves; 3*b*, buds and flowers; 3*c*, staminal ring, which is very deciduous; 3d, anthers. A very large and very old tree in a paddock about ¼ mile north-west of St. Mary's Station (W. F. Blakely and J. L. Boorman.)

4*a*, 4*b*, 4*c*. Leaves of various sizes; 4*d*, buds. Anthers the same as 3*d*. On the Richmond road, ¼ mile from St. Mary's Station (W. F. Blakely and J. L. Boorman).

The following species of Eucalyptus are illustrated in my "Forest Flora of New South Wales"* with larger twigs than is possible in the present work; photographs of the trees are also introduced wherever possible. Details in regard to their economic value, &c., are given at length in that work, which is a popular one. The number of the Part of the Forest Flora is given in brackets :—

acacioides A. Cunn. (xlviii).
acmenioides Schauer (xxxii).
affinis Deane and Maiden (lvi).
amygdalina Labill. (xvi).
Andrewsi Maiden (xxi).
Baileyana F.v.M. (xxxv).
Baueriana Schauer (lvii).
Baueriana Schauer var. *conica* Maiden (lviii).
Behriana F.v.M. (xlvi).
bicolor A. Cunn. (xliv).
Boormani Deane and Maiden (xlv).
Bosistoana F.v.M. (xliii).
Caleyi Maiden (lv).
capitellata Sm. (xxviii).
conica Deane and Maiden (lviii).
Consideniana Maiden (xxxvi).
coriacea A. Cunn. (xv).
corymbosa Sm. (xii).
crebra F.v.M. (liii).
Dalrympleana Maiden (lxiv).
dives Schauer (xix).
dumosa A. Cunn. (lxv).
eugenioides Sieber. (xxix).
fruticetorum F.v.M. (xlii).
gigantea Hook. f. (li).
globulus L'Her. (lxvii).
goniocalyx F.v.M. (vi).
hæmastoma Sm. (xxxvii).
hemiphloia F.v.M. (vi).
longifolia Link and Otto (ii).
Luehmanniana F.v.M. (xxvi).
macrorrhyncha F.v.M. (xxvii).
maculata Hook. (vii).
melanophloia F.v.M. (liv).
melliodora A. Cunn. (ix).
microcorys F.v.M. (xxxviii).
microtheca F.v.M. (lii).
Muelleriana Howitt (xxx).
numerosa Maiden (xvii).
obliqua L'Hérit. (xxii).
ochrophloia F.v.M. (l).
odorata Behr and Schlectendal (xli).
oleosa F.v.M. (lx).
paniculata Sm. (viii).
pilularis Sm. (xxxi).
piperita Sm. (xxxiii).
Planchoniana F.v.M. (xxiv).
polyanthemos Schauer (lix).
populifolia Hook. (xlvii).
propinqua Deane and Maiden (lxi).
punctata DC. (x).
radiata Sieb., as *amygdalina* (xvi).
regnans F.v.M. (xviii).
resinifera Sm. (iii).
rostrata Schlecht. (lxii).
rubida Deane and Maiden (xliii).
saligna Sm. (iv).
siderophloia Benth. (xxxix).
sideroxylon A. Cunn. (xiii).
Sieberiana F.v.M. (xxxiv).
stellulata Sieb. (xiv).
tereticornis Sm. (xi).
tessellaris F.v.M. (lxvi).
Thozetiana F.v.M. (xlix).
viminalis Labill. (lxiv).
virgata Sieb. (xxv).
vitrea R. T. Baker (xxiii).

---

* Government Printer, Sydney. 4to. Each part contains 4 plates and other illustrations.

War conditions have so largely affected publications that it is no longer possible to continue the issue of "The Forest Flora of New South Wales" at the old rates, and from this date onward, *i.e.*, from and including Part 7, Vol. VII, vii, the price of the individual Parts will be raised to 2s. 6d. each.

NOTE BY GOVERNMENT PRINTER.

For those Parts already published the old sale price will be adhered to, and subscriptions already received will not be disturbed, but the new subscription rate of 2s. 6d. per part, or 25s. for 12 parts, will come into effect as from the 1st July, 1921.

F

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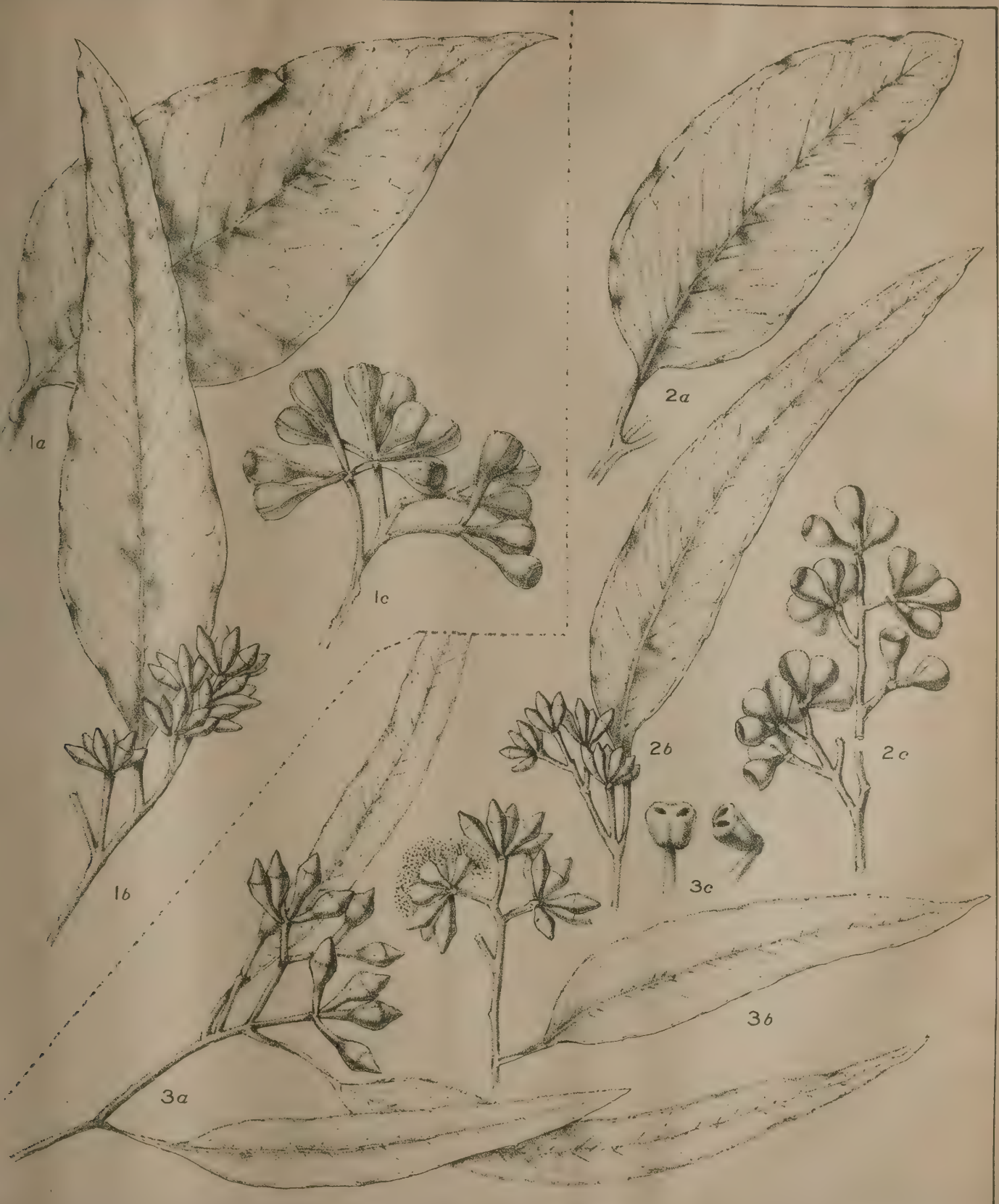
EUCALYPTUS PANICULATA Sm. [See also Plates 57 and 197.]



M. Flockton. del. et lith.

EUCALYPTUS PANICULATA SM. [See also Plates 57 and 196.]

(*E. Fergusoni* R. T. BAKER, Fig. 1, *E. Nanglei* R. T. BAKER, Figs. 2 and 3. both drawn from the types.)

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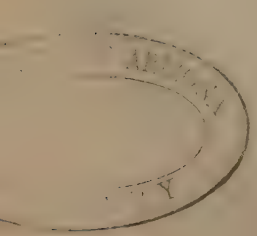
EUCALYPTUS DECORTICANS (F. M. Bailey) Maiden (*1*).
E. CULLENI R. H. Cambage (*2*).

LIBRARY

EUCALYPTUS BEYERI R. T. BAKER (*1, 2*).

[See also Fig. 21, Plate 57.]



A Critical Revision of the genus Eucalyptus

BY

J. H. MAIDEN, I.S.O., F.R.S., F.L.S.

(Government Botanist of New South Wales and Director of the Botanic Gardens, Sydney).

Vol. V. Part 9.

Part XLIX of the Complete Work.

(WITH FOUR PLATES.)

"Ages are spent in collecting materials, ages more in separating and combining them. Even when a system has been formed, there is still something to add, to alter, or to reject. Every generation enjoys the use of a vast hoard bequeathed to it by antiquity, and transmits that hoard, augmented by fresh acquisitions, to future ages. In these pursuits, therefore, the first speculators lie under great disadvantages, and even when they fail, are entitled to praise."

MACAULAY'S "ESSAY ON MILTON."

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DESCRIPTION.

CCLXXVIII. E. drepanophylla F.v.M.

Ex Bentham in B.Fl. iii, 221 (1866).

Following is the original description :—

A tree, usually low and stunted, the bark dark-grey and ribbed (Dallachy).

Leaves long-lanceolate, often exceeding 6 inches and usually falcate, acuminate, with numerous fine, parallel, and very diverging veins, often scarcely conspicuous, the intra-marginal one close to or very near the edge.

Umbels three to six-flowered, usually three to four together in short axillary or terminal panicles or the lower ones solitary, the peduncles short and terete, or nearly so. Calyx-tube obconical, nearly 2 lines long, tapering into a short, thick pedicel.

Operculum conical or obtuse, usually about as long as the calyx-tube.

Stamens about 2 lines long, inflected in the bud; anthers very small, nearly globular, with distinct parallel cells.

Fruit subglobose-truncate, about 4 lines diameter, slightly contracted at the orifice, the rim rather thin, the capsule somewhat sunk, but convex, so that the valves often slightly protrude.

E. drepanophylla is referred to as a synonym of *E. leptophleba* F.v.M. in Part X of the present work, p. 332, following Mueller. At p. 333 I invited the attention of Queensland botanists to this little known species. Owing to the zeal of Dr. T. L. Bancroft, then of Stannary Hills, north Queensland, and now of Eidsvold, I was able to clear up the identity of *E. leptophleba* as apart from *E. drepanophylla*. See *Journ. Roy. Soc. N.S.W.*, xlvii, 82, 83, and also the present work. I am also under obligations to Mr. C. T. White, Government Botanist, of Queensland, in this enquiry.

Further references to *E. drepanophylla* will be found under "Range," Part X, p. 333, and "Affinities," p. 334.

I am not quite certain that the differences between *E. drepanophylla* and *E. crebra* are sufficient to justify the retention of the former as a species, but on the whole think that it is probable. I trust that Queenslanders will give attention to the species.

It will be observed that certain old Ironbark specimens referred to *E. drepanophylla* by Mueller himself (and Bentham) are destitute of fruit, and Dallachy expressly mentions that his Edgecombe Range specimens had no fruit. At the same time, Bentham described the fruit as "sub-globose truncate, about 4 lines diameter, slightly contracted at the orifice, the rim rather thin, the capsule somewhat sunk, but convex, so that the valves often slightly protrude."

It will be observed that at figs. 3*d*, 4*b*, 4*c*, Plate 200, I have taken cognizance of fruiting specimens which probably come near the type.

RANGE.

The B.Fl., iii, 221, localities for *E. drepanophylla* will be found referred to at Part X, p. 333. So far as I know, *E. drepanophylla* is confined to Queensland, and its recorded localities are from the coast and coastal ranges from Maryborough to Cairns, but it may be confidently predicted it will be found north, south and west of the places indicated. The following specimens belong, in my view, to *E. drepanophylla*. Nos. 1–3 are from the Port Denison district, and are probably all typical :-

1. "Ironbark, the flowers white and sweet-scented; this is a very low (high—a correction by Dallachy) stunted tree in this country. Edgecombe, 15th August, 1863. No fruit." (Copy of Dallachy's label endorsed by Mueller "*Eucalyptus drepanophylla* Ferd. Mueller." This specimen has a second "Botanical Museum of Melbourne" label, in Mueller's handwriting, "*Eucalyptus drepanophylla* F.M., Port Denison," and this was seen by Bentham. It is undoubtedly the type.

2. Port Denison (Fitzalan). Specimen marked "*Eucalyptus drepanophylla*" by Mueller. Buds and anthers of this were figured as *E. leptophleba*, Pl. 48, fig. 4. (Mueller has a note :—"The tree from Port Denison, alluded to under *E. Bowmani* by Bentham in B.Fl., iii, 220, belongs to *E. drepanophylla*." (Eucalyptogrophia, under *E. Baileyana*.)

3. "*Eucalyptus drepanophylla* Ferd. Mueller. Burdekin Expedition. *Euc. crebra* var." (Copy of a label in Mueller's handwriting, seen by Bentham.)

Mount Elliott (south-west of Bowling Green Bay) in flower only (Fitzalan); (*E. drepanophylla*, so labelled by Mueller). This locality is a little north of Bowen.

Ironbark, Charters Towers (H. B. Walker, 1903). These specimens, in mature leaf, buds and flowers, with a piece of bark, appear to be *E. drepanophylla*. This locality is only a few miles inland from Bowen, home of the type.

Cleveland Bay (Townsville), in bud, pale-coloured operculum (S. (?) (Stephen Johnson, 1876); (labelled *E. drepanophylla* by Mueller). "Narrow-leaved Ironbark," Reid River, *via* Townsville. (Nicholas Daley and G. R. Skelton, through Dr. J. Shirley.)

Near Atherton, back of Cairns (District Forester H. W. Mocatta).

Stannary Hills, near Irvinebank (Dr. T. L. Bancroft, 17th March, 1901, and later dates. In June, 1909, Dr. Bancroft writes: "With rough bark, up to 100 feet high and 2 feet in diameter; timber red." He informs me that the late Mr. F. M. Bailey named it *E. crebra*. This is the most northerly locality known to me.

Now let us go south from Bowen, the type locality, and we have :—

"North Coast," R.Br., 1802–5, not in fruit, pale-coloured operculum; (probably either Keppel Bay or Shoalwater Bay. as quoted in B.Fl.. iii, 221, under *E. drepanophylla*).

Mullet Creek, between Bundaberg and Gladstone, North Coast Railway (Chief Engineer for Railways, through C. T. White).

The common Ironbark of the district, medium to large-sized trees, 30–60 feet high, fairly plentiful. Mount Perry (J. L. Boorman).

Parish Boondooma, Burnett district (S. J. Higgins, through C. T. White, No. 11). "Narrow-leaf Ironbark." "A form of *E. crebra*, with Weeping Willow habit. A really pretty tree; I have often wondered if it is a hybrid." Eidsvold, Upper Burnett River (Dr. T. L. Bancroft.) These specimens, varying somewhat in width and texture of leaf, show how difficult it is to separate *E. crebra* and *E. drepanophylla*. Both of these localities are a little west of Maryborough, and form our most southerly records at present.

AFFINITIES.

1. With *E. crebra* F.v.M.

"*E. drepanophylla* differs from *E. crebra* chiefly in the large flowers and in the larger, harder, and more globular fruit. . . . It is not impossible, however, that . . . *E. drepanophylla* . . . and *crebra*, all of them Ironbarks, may be but forms of one species." (B.Fl., iii, 221.)

"*E. drepanophylla*, which may be perhaps a mere variety of the imperfectly known *E. leptophleba*, is still nearer to *E. siderophloia* than to *E. crebra*; (and then follows differences from *E. siderophloia*). ("Eucalyptographia," under *E. siderophloia*).

"*E. drepanophylla*, which was advanced with much hesitation as a species ("Flora Australiensis," iii, 221), seems mainly to differ in more stunted habit, larger and stiffer leaves of a paler hue, larger flowers and fruits and, perhaps, different bark. This species or variety, for the elucidation of which further field studies are needed, extends northward to the Palmer River (Th. Gulliver), Cape Sidmouth (C. Moore), and Trinity Bay (Walter Hill), and, on the authority of Bentham, even to the north-west coast of Australia (Cunningham)." (*Ib.*, under *E. crebra*).

"*E. drepanophylla*, which comes very near to *E. leptophleba* and *E. crebra*, belongs to the series of Ironbark trees (with, therefore, furrowed and dark-coloured bark), has usually narrower leaves of less straightness and of lighter green, with very subtle much diverging and also more copious veins, a shorter lid, anther-cells slit in their whole length and proportionately shorter fruits. To *E. drepanophylla* verges Bentham's variety *parviflora* ("Flora Australiensis," iii, 217) mentioned doubtfully under *E. hemiphloia*; it is according to Fitzalan's note an Ironbark Tree; the anthers, however, seen not to open with regular slits." (*Ib.*, under *E. hemiphloia*).

It seems to me that important differences between *E. crebra* and *E. drepanophylla* lie in the broader juvenile leaves of the latter and in the shape of the anthers.

2. With *E. leptophleba* F.v.M.

This is dealt with under *E. leptopleba*, see p. 267.

DESCRIPTION.

XXXVIII. E. leptophleba F.v.M.

In *Journ. Linn. Soc.*, iii, 86 (1859).

A TRANSLATION of the original description will be found at Part X, p. 332.

It is briefly described in B. Fl., iii, 221, in the following words :—

A moderate sized or large tree, with a dark, persistent, rugged bark, of which only fragmentary fruiting specimens have been preserved. These appear to me to differ but slightly from *E. crebra* in the leaves rather thicker and broader, and in the fruits much larger, attaining 4 lines diameter, or rather more. There is some confusion here with *E. drepanophylla*. [See p. 267. J.H.M.]

Then we have :—

E. leptophleba, or Blackbutt, is a large tree of quick growth, rising to a height of about 100 feet, with a diameter of 3–4 feet; bark dark, persistent, and separating into numerous small pieces (similar to that of *E. tessellaris*) on the trunk, grey, smooth, and deciduous on the branches. This tree has the general appearance of *E. tereticornis*, with the bark of *E. tessellaris* and the fruit of *E. crebra*. The wood is red, hard, and durable, but not much used, in consequence of being generally hollow in the centre. (P. O'Shanesy, of Rockhampton.) "Contributions to the Flora of Queensland," 1880, p. 40.

"Yudhulwan" is the aboriginal name, according to Mr. O'Shanesy, who was writing on the Eucalypts between Rockhampton and the Drummond Range.

E. leptophleba has the bark more greyish, less furrowed (than *E. crebra*), and rather wrinkled, breaking up into numerous small, angular pieces in the manner of *E. tessellaris*; hence it belongs to the Rhytiphloiæ not Schizophloiæ; its flowers remained unknown, but its lid is double in an early state of growth. To *E. leptophleba* seems also to belong a tree, observed by Mr. P. O'Shanesy on the Comet River, which sheds the outer layers of its bark from the branches and upper part of the stem; the persistent portion of the bark resembles that of *E. tessellaris*, but the leaves are more prominently veined, and the fruit is often five-valved, and occasionally even six-valved. (Eucalyptographia under *E. crebra*).

I have mentioned below, p. 267, that I do not think that Mr. O'Shanesy's tree is free from doubt.

Seeing my note (Part X, p. 333) to the effect that the juvenile leaves of *E. leptophleba* were unknown, Dr. T. L. Bancroft, then of Stannary Hills, North Queensland, where the species is abundant, obligingly sent me juvenile leaves. They are elliptical or nearly oblong in shape, very coriaceous, equally green on both sides, and $4\frac{1}{2}$ inches in breadth by 7 inches in length are common dimensions. The veins are prominent, roughly parallel, and often nearly at right angles to the midrib. The intramarginal vein is at a considerable distance from the edge.

I have classified recorded notes on the bark in *Journ. Roy. Soc. N.S.W.*, xlvii, 81, as follows :—

1. Bark dirty grey, rugose, fissured on trunk and persistent on the branches. This is the original description.

2. " An Ironbark " (B.Fl., iii, 221, under *E. drepanophylla*). A mistake arising out of the long-continued confusion with *E. drepanophylla*.

3. Dark persistent rugged bark (*ib.* under *E. leptophleba*). Perhaps this is intended for a free translation of the original description.

4. " Breaking up into numerous small angular pieces in the manner of *E. tessellaris* " (Eucalyptographia, under *E. crebra*).

5. " A box, hardly to be distinguished from *E. populifolia*." (Dr. T. L. Bancroft, in a letter to me).

Mr. R. H. Cambage favoured me with a photograph of the tree, which is a Box. I hope to reproduce my photographs of typical Eucalyptus barks later.

SYNONYM.

E. Stoneana F. M. Bailey in *Queensland Agric. Journ.*, xxiii, p. 259 (1909) with two plates.

The type comes from Stannary Hills, North Queensland (Dr. T. L. Bancroft).

Mr. Bailey described it as follows :—

Bastard Gum-leafed Box of the locality. Plates 31 and 32. A large tree with a rather close, hard, persistent greyish bark, about ½ inch thickness. Wood, outer yellow, inner red. Branchlets angular, slender, and probably more or less glaucous when fresh. Leaves alternate, thin-coriaceous, 6 to 10½ inches long, from 7 lines to 3 inches wide, broadest and roundly-cuneate at the base, the apex blunt or acuminate; margins more or less repand, midrib alone prominent, principal parallel transverse nerves distant, but faint like the reticulate veins, the intra-marginal nerve always close to the edge of leaf. Oil-dots very numerous and minute. Petioles slender, from ½ to 1¼ inch long. Inflorescence axillary, panicles elongated, primary peduncles about 1 inch long, secondary 9 lines, irregularly angled, bearing umbels of from two to six flowers, often somewhat crowded at the end of the branchlets. Flowers, when fully expanded, about 1 inch diameter. Operculum thin, hemispherical, or with a very minute point. Stamens about 4 lines long, inflected in the bud, all fertile, in three irregular rows. Anthers globose, bursting at the top. Style slightly exserted, stigma peltate, scarcely larger than the style. Fruit oval-globose, including the pedicellate lower-half about 8 lines long, diameter about 4 lines at the top, the outside portion smoothish, the lower pedicel-like portion angular; rims thin, capsule deeply sunk, the top dome-shaped; cells four or five. Seed dark brown, bluntly triangular to thick cuneate and furrowed, about 1 line long.

RANGE.

It is only known from Queensland. The type comes from the Gilbert River, which flows into the Gulf of Carpentaria, near its south-eastern corner. Its known localities near are from Cape York, along the eastern side of the Gulf of Carpentaria, and southerly to the Burdekin River, apparently at no very great distance from the sea. Its identity has only recently been established, and therefore the attention of collectors is invited to it.

[" *E. redunca* is bounding east and west an extensive longitudinal belt of *E. leptophleba*, as shown in an excellent map, issued recently with an important document by the W.A. Forest Board." (" Eucalyptographia," under *E. redunca*.) This is probably the " Map of part of the Colony of Western Australia showing timber forests of . . . ." (six principal timbers), published in 1880. It is probably a misprint for *loxophleba* (*foecunda*), the York Gum—*E. leptophleba* not occurring in Western Australia. The correction is published as the mistake is somewhat serious, because *E. leptophleba* is so little known, even yet.]

Following are some specimens I have authenticated, or which are in the National Herbarium, Sydney :—

Sources of the South Coen River, York Peninsula, in fruit (Stephen Johnson). (Labelled *drepanophylla* by F.v.M.) Figured as *E. leptophleba* at fig. 3, Plate 48, Part X.

" Endeavour River, N. Holland, Lieutenant King " (afterwards Admiral P. P. King), ex herb. Lambert in herb. Cant. Ripe fruits figured as *E. leptophleba*, fig. 5, Plate 48.

Palmer River, in fruit only (? Th. Gulliver). (Referred to as *E. drepanophylla* in " Eucalyptographia," under *E. crebra*.

Daintree River (Fitzalan), in flower only. Labelled *E. drepanophylla* by Mueller.

" S.E. Carpentaria, Box-tree," in fruit only. (E. Palmer, 1882). Labelled *E. drepanophylla* by Mueller.

Trinity Bay (Cairns). Referred to *E. leptophleba* by Mueller himself.

In bud, Rockingham Bay (Dallachy). Labelled *E. leptophleba* by Mueller.

" Grey Box." Chillagoe, west of Cairns (E. Doran, No. 10).

Eucalyptus leptophleba was noticed soon after the forest country was entered, and it extends westerly to Alma-den and towards Forsayth, but from about this latter locality it seems to give place to a smaller and paler-coloured form of Box Tree (No. 4162), which was found intermittently as far west as the Flinders and Cloncurry Rivers. *E. leptophleba* is a Box tree with a rather thick bark and long leaves, the rough bark extending to the branchlets. The timber is reddish-brown, with a fairly thick sapwood. It seems to favour the low, rather than the hilly land. (R. H. Cambage, in *Journ. Roy. Soc. N.S.W.*, xlix, 397, 1915.)

" Box-trees, more on the lowlands than on the hills. Box-bark to branchlets. Wood reddish-brown towards centre. Rather thick rim of sapwood on small tree. Trees up to 60 feet. On granite at 1,600 feet. Alma-den (R. H. Cambage, No. 3903, with photo.).

" Bastard Gum-leaf Box." Timber red. Stannary Hills, south-west of Cairns (Dr. T. L. Bancroft). Dr. Bancroft supplied me with a fine series of specimens, leaving nothing to be desired in completeness.

Ravenswood, Burdekin River, in fruit (S. Johnson, No. 15, 1883). Labelled *E. drepanophylla* by Luehmann.

" Dispersed through the scrubby country westward from Gogango." (P. O'Shanesy, of Rockhampton.) As this is much the most southerly locality recorded, it would be desirable to confirm it, although O'Shanesy doubtless got the determination from Mueller. I have suggested (*Journ. Roy. Soc. N.S.W.*, xlvii, 81, 1913) that perhaps O'Shanesy's tree may be *E. Cambageana* Maiden.

AFFINITIES.

1. " Near to *E. patellaris* F.v.M." (Original description.)

For *E. patellaris* see Part XXXIX, p. 257, with figs. 7*a–d*, Plate 163. It is a species very little known, evidently also a Box. Only one authenticated specimen is known, a portion of which is figured. It differs from *E. leptophleba* in the more strongly marked venation of the leaves and in exsertion of the valves of the fruits. Mueller's statements as to the affinity of the two species, collected by him at nearly the same time, and described by him shortly afterwards, must be respected, and we can say no more until *E. patellaris* is rediscovered.

2. With *E. crebra* F.v.M.

Bentham (B. Fl., iii, 221) says that the fragmentary fruiting specimens " appear to me to differ but slightly from *E. crebra* in the leaves rather thicker and broader, and in the fruits much larger, attaining 4 lines diameter or rather more." Bentham was referring to what he looked upon as a coarse form of *E. crebra* named *E. drepanophylla*, and that form and *E. leptophleba* have been thoroughly confused, as already indicated. *E. crebra* is, however, an Ironbark, and *E. leptophleba* a Box.

I confess I do not see its close affinity at the present time. It is one of the most coarse foliaged of all species of Eucalyptus, and it has very large flowers and fruits for a Box—one with a red timber. Indeed, it seems closer in superficial resemblance of herbarium material to some of the Ironbarks, which has caused the confusion with *E. drepanophylla*. *E. pruinosa*, a tropical " Box," somewhat resembles it in the fruits.

DESCRIPTION.

CCLXXIX. E. Dalrympleana Maiden.

In "Forest Flora of New South Wales," vol. vii, Part IV, 137 (1920).

FOLLOWING is the original description :—

White Gum grandissima, cortice sæpe maculis claris et lamellis longis tenuibus secedente, ligno carneo. Foliis juvenilibus pallidis cordatis vel orbicularibus vel ovoideis, amplexicaulibus, sessilibus vel brevissime petiolatis. Venis patentibus. recticulatis. Foliis maturis petiolatis, lanceolatis, falcatis rare minus 1 dcm. longis et 2 cm. latis, venis patentibus vena peripherica a margine distincte remota. Inflorescentia axillare, 3 floribus breve pedicellatis cruciformibus. Alabastrorum calycis-tubo cylindroideo, angulare, operculo conico æquilongo margine commissurata distincte. Fructibus truncato-ovoideis, ca. 8 mm. diametro, margine rotundata vel plana, non lata, valvis 3 vel 4 mediocriter exsertis.

A large tree, sometimes attaining an enormous size. "I have seen them 30 feet in girth, with a barrel of almost 100 feet. They are generally 15 or 16 feet in girth. Known locally as 'Mountain Gum' or 'White Gum.' The trees present a remarkable appearance. During early spring the bark is quite white, but later this changes to a vivid red (sometimes almost vermilion), and the trunks have the appearance of being painted in large irregular blotches. Timber pinkish in colour, and dries irregularly." (W. A. W. de Beuzeville.)

Branchlets angular, juvenile leaves scabrous in the earliest stage, pale-coloured, cordate to orbicular or ovoid, stem-clasping, sessile, or with very short petioles, with a short innocuous point; 5 cm. long and 5 cm. broad are average dimensions. Venation spreading, reticulated, the leaf dotted with black spots, scarcely seen with the naked eye.

Mature leaves petiolate, lanceolate, usually more or less falcate, rarely under 1 dm. long and 2 cm. wide, venation spreading, intra-marginal vein distinctly removed from the edge; black-dotted.

Inflorescence axillary, petioles flattened, under 1 cm. long, supporting three shortly pedicellate appressed, rarely cruciform, flowers of medium size. The buds with cylindroid calyx-tube, angled, with a conical operculum of equal length. Commisural rim marked. Anther small, opening in parallel slits. Gland at the back.

Fruits truncate-ovoid, about 8 mm. in diameter, rim rounded or flat-topped, not broad, valves three or four, moderately exsert.

Named in honour of Richard Dalrymple Hay, Chief Commissioner of Forests of New South Wales, whose name will ever be connected with his arduous endeavours, extending over a number of years, to place the working of the forests of New South Wales on a sound basis.

RANGE.

The typical form is found in the Yarrangobilly, Batlow, and Tumberumba districts, and it has been found in the mountainous country in the counties of Wellesley, Wallace and Selwyn, in south-eastern New South Wales. It has been so long confused with other White Gums, that there is little doubt that its range will be very greatly extended on critical inquiry.

It undoubtedly occurs in the adjacent country in Gippsland, Victoria. It is highly probable that the "broad-suckered *viminalis*" from Tasmania (*e.g.*, Hobart), (Chimney Pot Hill, L. Rodway) and Sheffield (R. H. Cambage), and the Dee (J.H.M.), referred to in my paper in *Proc. Roy. Soc. Tas.*, 1918, p. 88, belongs to this species.

Following are some representative specimens from New South Wales:—

"A Mountain Gum." Peppercorn Plain, Yarrangobilly, about 20 miles north of Kiandra, elevation about 4,700 feet. W. A. W. de Beuzeville, Nos. 1, 2, 3. A large tree as described in his letter, No. 409120, January, 1920. (The type.)

"Mountain Gum," Bago Forest Reserve, Batlow district (de Beuzeville, No. 1, January, and also March, 1917).

"A White Gum," Yellowin Creek, Bago Forest Reserve (de Beuzeville, No. 2, January, 1917).

"Large Gum-trees," Laurel Hill, Tumberumba (R. H. Cambage, No. 847). Considered at one time as coming between *E. rubida* and *E. ovata* (*acervula*).

"This is like a broad-suckered *E. viminalis*, but the timber is much inferior to the ordinary. This tree grows generally on poor soil, and is usually stunted. Occasonally a large specimen may be seen growing with the ordinary *viminalis*." Tallaganda Forest, Braidwood-Queanbeyan district (W. A. W. de Beuzeville, October, 1918, No. 14).

"An inferior White Gum," Parker's Gap, same general locality (de Beuzeville, October, 1918, No. 5).

(Mr. de Beuzeville's No. 9, same place and date, is called "Ribbon Gum," and has the conventional narrow suckers of *E. viminalis*.)

AFFINITIES.

This question has been dealt with at length at "Forest Flora," p. 138, to which my readers are referred, and it will be sufficient to give the following table showing the differences between it and *E. rubida* Deane and Maiden and *E. viminalis* Labill., the two nearest species :—

	1. *Dalrympleana.*	2. *rubida.*	3. *viminalis.*
Size and habit of tree.	Very large, erect, non-glaucous tree.	Not very large; smaller than *E. Dalrympleana.* Grows on poorer soils. Glaucous.	Frequents good moist soil. Large size.
Bark	Smooth, spotted or patchy, very thick; sometimes 2 inches thick. More or less rough at butt.	Smooth, spotted or patchy, thickish, but not so thick as that of *E. Dalrympleana.*	Moderately thick; not very patchy; much less ribbony than the other two.
Timber	Pale-coloured, shrinks irregularly. Not much tensile strength. Valuable for building purposes, when kept under cover. Valuable for paper-pulp.	Much more brittle than that of *E. Dalrympleana.*	Good. Few gum-veins.
Seedlings and Suckers.	Broadish; glaucous, but less so than those of *E. rubida.*	Broad, glaucous	Narrow, non-glaucous.
Mature leaves ...	Non-glaucous	Dull green, or glaucous ...	Non-glaucous; have sweet ethereal smell.
Buds	Elongated, usually in threes. Rarely cruciform. Has a flowering season in its type locality, nearly a couple of months earlier than *E. rubida*	Ovoid, often glaucous. Operculum nearly hemispherical. Usually in threes, cruciform.	Same as (1). Usually in threes.
Fruits	Nearly globose, with very protruding valves, usually about 6 mm. diameter. Banded rim.	More urceolate. Top-shaped; 3 lines diam. Less banded. Smaller than those of (1).	Like (1).
	Found on easterly and northerly slopes in its type-locality (Tumberumba district).	Found on westerly and southerly slopes (Tumberumba district).	Most usually found on river or creek banks.

CCXVII. E. dichromophloia F.v.M.

This species is dealt with in Part XL, but in Plate 165 no leaf earlier than an intermediate leaf is figured.

In Part XLI, p. 3, the juvenile leaves of *E. dichromophloia* are described for the first time, but not figured. They are now figured at fig. 3*a*, Plate 202 of the present Part (see p. 230 below).

Dr. H. I. Jensen tells me that the species seems very widespread on poor country in Queensland, while *E. terminalis* is found on better, moister land.

DESCRIPTION.

CCLXXX E. Hillii Maiden.

In Journ. Roy. Soc. N.S.W., liii, 64 (1919).

Following is the original description :—

Arbor mediocris, cortice tenere squamosa, ramis lævibus, ligno duro rubro-brunneo. Foliis primariis longe petiolatis, magnis, irregulariter orbicularibus, apice rotundato vel obtuso, glabris crassis venis fere pinnatis, margine undulato. Foliis maturis similibus sed minoribus. Inflorescentia racemosa, floribus paucis plerumque 4 in umbella, pedunculis longis, teretibus. Calycis tubo piro simile formato circa ·5 cm. diametro in pedicellum 1 cm. angustato. Operculo haemispherico vel conico calycis tubo æquilongo. Antheris longis longitudinaliter aperientibus. Fructus non vidimus.

A broad-leaved tree of medium size, the bark somewhat tessellated or soft scaly, the branches smooth. Timber rich reddish-brown, "hard."

Juvenile leaves with very long petioles, irregularly orbicular, the base flat or slightly tapering into the petiole, the apex rounded or blunt, the venation pinnately spreading; glabrous, thick and leathery the margin undulate, large, say 14 cm. broad by 12 long (5½ by 4¾ inches).

Mature leaves very similar to the juvenile ones, but smaller, with some tendency to becoming broadly-lanceolate, with the secondary veins making a smaller angle with the midrib.

Buds few in an umbel, usually four, the umbels forming a racemose inflorescence. The long peduncles terete or slightly flattened. The calyx-tube pear-shaped, about ·5 cm. in diameter, tapering into a pedicel of 1 cm. The operculum hemispherical with a slight umbo or conical, of about the same length as the calyx-tube.

Anthers long, opening in parallel slits, gland at top, filament at base, with affinity to the semi-terminal ones. Style conspicuous, the stigma not exceeding it in width.

Fruit not seen.

Type from Bathurst Island (Gerald F. Hill, No. 468).

RANGE.

I have only received it from Bathurst Island (which is to the immediate west of Melville Island, and with it forms a huge double island off the Northern Territory, north of Darwin).

It grows in somewhat heavy soil, in rather flat localities (presumably subject to floods) and associated with *E. papuana*, *E. terminalis* and an occasional No. 464. (*E. latifolia* F.v.M.) (G. F. Hill).

A photograph of a moderately dense forest, taken by Mr. Hill, shows the distinct outlines of a tree of this species about 40 feet high, with a diameter of about 2 feet. There is, partly in the foreground, a tree of the same species, perhaps 50 feet high.

AFFINITIES.

1. With *E. oligantha* Schauer.

Its closest affinity appears to be with this species, but *E. oligantha* has paler foliage, urceolate calyx-tube, which does not continuously taper into the pedicel, much shorter filaments, and capitate stigmas. The anthers of the two species are similar, but not identical. *E. oligantha* is described as shrubby (but later it may prove to attain tree size), but we know nothing of its bark and timber. The fruits of neither species are known.

2. With *E. Spenceriana* Maiden.

As a rule this species has thin, graceful, lanceolate leaves, but occasionally it has coarser foliage, *e.g.*, the Stapleton, Northern Territory, plant shown at fig. 4, Plate 156, C.R. But even in that tree, which presents a good deal of similarity to a tree of *E. Hillii*, the foliage is not broad as a whole. Also, the bark of *E. Spenceriana* is not tessellated; it is a Box. The fruit of *E. Spenceriana* is small and of papery or angophoroid texture, which that of *E. Hillii* can never be.

3. With *E. alba* Reinw.

A large leaved, long petiolate species suggesting a similarity to *E. alba*. For that species Plates 105–7, C.R., may be referred to. But *E. alba* differs in buds and anthers, and in developing into lanceolate leaved forms.

THE GROWING TREE.

(Continued from p. 259, Part XLVIII.)

E.—Nanism.

Nanism or dwarfing may arise from more than one cause, or from a combination of them. As a rule, the most obvious factor is prevalence of strong winds, and where this is accompanied by shallowness of soil, we have a couple of important factors. It is notorious that trees become dwarf in exposed situations near the sea, and on high mountains; indeed, we can trace the diminishing size of a species according to the varying shelter individuals receive.

Examples of the effects of the strong sea air in diminishing size, taken almost at random, are, at First Point, near Kincumber, Broken Bay, New South Wales, where Mr. R. H. Cambage and I saw *E. resinifera* Sm. flowering at 4–5 feet, *E. umbra* R.T. Baker at 4–5 feet, *E. paniculata* Sm. at 6 feet. Normally these species are medium-sized to large trees.

F.—The Flowering of Eucalypts while in the Juvenile-leaf Stage.

"The generative maturity of plants is not connected immutably with a definitive stage of development." There seem so many cases in which flowering and fruiting have been found to occur in the opposite-leaved stage that it seems fair to assume that further experience will show that it may occur in very many more—perhaps in all species.

Naudin's First Memoir, 347 (1883) says, after speaking of the adventitious leaves "which take on the appearance of the juvenile stage. . . ," "this retrogression towards anterior forms, and which is like a partial rejuvenation of the tree, is not an obstacle to the flowering; these branches of juvenile aspect sometimes flower and ripen the fruits as well as those of the adult form." He seems to have been the first botanist who made this observation.

In 1906 Dr. L. Diels published his "Jugendformen und Blütenreife im Pflanzenreich," and I cannot do better than quote portions of a review of it by C. R. Barnes which appeared in the *Botanical Gazette*, vol. 45, p. 137 (February, 1908). The work deals, *inter alia*, with the question of precocious blooming, and the genus Eucalyptus is illustratively employed.

> An interesting discussion of the relations between the vegetative form and the flowering period of plants is presented by Dr. Diels. . . . The questions with which the book deals were raised by the author's travels in West Australia in 1902. After his return he examined the literature, and made further investigations to throw light upon the problems of form in the plant kingdom. He has gathered together

a considerable number of examples of the relation between form, blooming time, and external conditions. These he presents and discusses in his usual luminous fashion. He has even cited briefly analogous phenomena, not a few from the animal kingdom.

The thesis of the book is that the generative maturity of plants is not connected immutably with a definitive stage of their development, as has been so widely held. A certain minimum of nutritive preparation is presupposed; but once this is passed, there is a broad variation zone in which blooming occurs. Its appearance is dependent upon complex, largely unknown conditions, an important part of which, however, are external. The vegetative ontogeny depends upon the co-operation of autogenous and exogenous (an excellent substitute for the awkward term "aitiogenous") factors; for the rudiments of the vegetative organs have many possibilities, and which one is realised is determined by the environment. The mature form of the entire organism is thus a product of vegetative ontogeny and of generative maturity, both of which factors are variable, though their variability is not in the same direction. True, the development of vegetative structures usually ceases at blooming, but this is the only place where the two lines of development, the vegetative and the generative, are inseparably connected. Elsewhere they are free and independent of one another, and each varies after its own manner. In this connection of two variable factors lies an important impulse to increase the manifold forms of the plant world. For the conditions which help to regulate the succession of leaf forms and floral maturity change with the changes of climate in space and in time, giving rise to local geographic species and allowing true species to arise in the course of time. Their features attain heritability, and become therewith a source of new lines with new possibilities.

A new term, "helicomorphy," is suggested to comprehend Goebel's two terms for the two-leaf forms in heteroblastic species, the juvenile forms and successive forms. In the course of a short chapter on the phylogenetic significance of helicomorphy, the author pays his respects to the famous "biogenetic law," that ontogeny recapitulates phylogeny, in these terms: "In the botanical field it has absolutely no (nicht einmal immer) heuristic value, and whoever allows himself to be led by it will at most succeed in satisfying the needs of his imagination."

In the genus Eucalyptus we are accustomed to see—

1. Plants flowering when in the mature lanceolate-leaved stage. The juvenile leaves may be, and usually are, of a different shape. This is heteroblasticity.

2. In a few cases the leaves maintain their juvenile form through life. (Isoblasticity or homoblasticity.)

3. In a number of cases, and careful observation increases the number from time to time, we find plants which normally fall under (1), flower as regards individual branches, while in the juvenile stage.

At p. 97 of Dr. Diels' work already referred to, he says (translation):—

Everywhere in Eucalypts are shown close relations between juvenile forms and flowering maturity. It will be a very useful work for the Australian botanists to add new facts by observation in the field and in cultivation. Thereby it will perhaps also be possible to find out the conditions, of which we know very little at present. There is at least one fact which manifests itself empirically: *The number of forms which flower while their foliage is in the juvenile state is specially numerous in regions where the surrounding medium is at a considerable distance from the optimum of the genus.* (N.B.—I have dealt with the question of Optimum at Part 69 of my "Forest Flora of New South Wales."—J.H.M.). The cool regions of Tasmania are rich in such forms. The dry plains of the North Australian sandstone tableland possess such species, and they are also found in the dry heaths of south-west Australia, which follow the interior border of the winter-rain region.

At. p. 17 he says:—

The reigning Australian genus Eucalyptus is marvellously elastic in the condition of growth and flowers. The most important instances will be given later (p. 88–98); for the present I will mention only a few cases given by Mueller, and from my personal observations in South-West Australia.

He then proceeds to quote the cases of *E. cordata*, *tetragona*, *reduncа*, *marginata*, and *occidentalis*.

" Flowering in a shrubby state " a (favourite expression of Mueller's), may not be identical with flowering while the leaves are in a retarded or juvenile state, but in a number of cases this is so. Of course some species are normally shrubby, and not because of nanism. In the following list I will indicate by (S) where I do not give further information, whether I have actually seen, or it has been reported to me, that the flowering is in the juvenile-leaved state.

E. Baeuerleni F.v.M. " Flowers at 5 feet." (W. Baeuerlen.)

E. Beyeri R. T. Baker. A tree apparently referable to this species. See Part XLVIII of the present work.

E. Blakelyi Maiden. See figure 1, Plate 134, Part XXXII, for a specimen at Hill End, New South Wales, flowering in the juvenile stage.

E. Bosistoana F.v.M. Under the name *E. Nepeanensis*, R. T. Baker has described a new species which is merely *E. Bosistoana* flowering while some of the foliage is in the juvenile stage.

E. calophylla R.Br. " At the east end of the Stirling Range of Western Australia, I found *E. calophylla* as Maalok, only 5 feet high, while in Red Gum Pass (crossing the Range) the trees were very large and one decaying trunk between 5 and 6 feet in diameter lay on the ground." (Dr. A. Morrison.) In the Stirling Range district I also have seen this species flower in a dwarf state. Dr. G. P. U. Prior, of the Mental Hospital, Rydalmere, Sydney, informs me that he has flowered *E. calophylla* var. *rosea* in two years from the sowing of the seed.

E. calycogona Turcz. Figured at D, Plate 9, Part III, we have an instance of inflorescence with juvenile foliage.

E. celastroides Turcz. See fig. B, Plate 10, Part III.

E. cinerea F.v.M. (S.)

" *E. cordata* Labill. is a medium-sized tree, but often it remains shrubby. Mueller writes (Eucalyptographia) ' I have rooted specimens before me, hardly 3 feet high, but nevertheless bearing flowers and fruits.' " (*Jugendform.*, p. 17.)

E. cosmophylla F.v.M. This is a medium-sized tree from Mount Lofty, South Australia. Dr. J. B. Cleland sowed seeds on 12th May, 1912, at Neutral Bay, Port Jackson. The plants flowered in 1917 and 1918. There were flower-buds on 25th October, 1918. The height was 10 feet 6 inches on 8th December, 1918.

E. diversifolia Bonpl. A cultivated plant in the Botanic Gardens, Sydney (W. F. Blakely, March, 1920).

E. dives Schauer. Mr. A. D. Hardy draws attention to the precocious blooming in this species in Victoria. See *Proc. Roy. Soc. Vict.*, XXIX (New Ser.) 170. Bentham pointed out the flowering of this species as a tall shrub. (S.)

Eudesmiæ. It seems to me that all Eudesmiæ flower in the opposite-leaved stage.

E. fasciculosa F.v.M. (S.) See Part XIV, p. 140.

E. ferruginea Schauer (S).

E. Foelscheana F.v.M., flowering at 18 inches. (S.)

E. gamophylla F.v.M. (S.)

E. gigantea Hook. f.

I have repeatedly seen this species flowering profusely when about 6 feet high, sometimes when not more than 3 feet, and on several occasions when it had reached a height growth of between 2 and 3 feet. As this species rarely suckers, it appeared to me that the early and profuse seeding powers were a compensating characteristic of the species. (W. A. W. de Beuzeville, Forest Assessor, Forestry Commission, Sydney.)

In another letter Mr. de Beuzeville says: "Regarding your inquiry as to the state of the foliage of this species when in the early flowering stage of 2 or 3 feet, I may say that you are quite right in your impression that it flowers in a juvenile-leaf stage. I have often seen the flowers on these flowering saplings fully 4 inches broad and about 5 inches long." This, therefore, is to be added to the list of tree species which also flower in a shrubby state, and also to the list of those that flower in a juvenile-leaved stage. (Maiden, in *Journ. Roy. Soc. N.S.W.*, LI, 449, 1917.)

E. globulus Labill. Mueller (Eucalyptographia) says, "On the storm-beaten rocks of Wilson's Promontory I have seen *E. globulus* profusely in flower and fruit, though dwarfed by exposure to the size of a mere shrub, when almost within the reach of oceanic spray."

Mr. A. D. Hardy sent me a twig of reversionary foliage from an introduced street-tree at Stawell, Victoria. The tree is of normal appearance, and bears buds, flowers and fruits plentifully. Near a fork were reversionary shoots, all fruit or flower bearing.

E. gracilis F.v.M. See fig. 1, Plate 12, Part III, of this work.

E. Houseana (W.V.F.) Maiden. We may have inflorescence both with mature and juvenile leaves in this species. See Plate 204, Part L of this work.

E. Kybeanensis Maiden and Cambage. Flowers in juvenile stage. See legend at p. 185, Part XLVI of the present work.

E. leucoxylon F.v.M. Mueller (Eucalyptographia) has seen the species flowering in a shrubby state, "even when the leaves were still opposite." Flowered and fruited freely at 4–6 feet on very poor shingly ground at Bacchus Marsh, Victoria, see Part XII, p. 90.

A red flowering form from Murray Bridge, S.A., collected by himself, had seed sown by Dr. J. B. Cleland at Neutral Bay, Port Jackson, 14th November, 1915. It flowered at a height of 11 feet 6 inches from 26th October, 1918, to 3rd December, *i.e.*, at three years old. The flowering twigs, as seen by me, were not, however, in the juvenile-leaf stage.

E. macrocarpa Hook. A dwarf Western Australian species. (S.)

E. marginata Sm. " The typical tree-form is confined to the more moist country, and will not be seen any more where the yearly rainfall is below 75 cm., but occasionally one will meet there with shrubby forms. (Dr. Diels.)

E. melanophloia F.v.M. (S.)

E. melliodora A. Cunn. This is a precocious flowering species, and when it flowers in a shrubby state the leaves are often large. (S.) See Part XIV, p. 135.

E. Moorei Maiden and Cambage. (S.)

E. occidentalis Endl. (Quoted by Diels.)

E. perfoliata R.Br. See fig. 3*a*, Plate 180, Part XLIV, showing that it may flower in the juvenile stage.

E. Planchoniana F.v.M. Flowers at Stradbroke Island, Queensland, as a stunted bush of a few feet (C. T. White).

E. polyanthemos Schauer. Flowering as a shrub of 8 or 10 feet, at Quiedong, near Bombala, New South Wales (W. Baeuerlen, March, 1887).

E. præcox Maiden. See Part XXVII, p. 131 (last paragraph but one), and fig. 13*e*, Plate 112. Inquiry is going forward as to whether the remarks under *E. Bosistoana* (*Nepeanensis*) apply here.

E. pulverulenta Sims. (S.)

E. pyriformis Turcz. (S.)

E. Raveretiana F.v.M. Flowers when only 10 feet high (Mueller in " Eucalyptographia.")

E. redunca Schauer. (Quoted by Diels.)

E. Risdoni Hook. f. (S.)

E. rostrata Schlecht. Mr. A. D. Hardy draws attention to a case of precocious blooming in this species near Melbourne. (*Proc. Roy. Soc. Vict.*, xxix, (New Ser.), 171).

E. rubida Deane and Maiden. For figure of this species flowering in juvenile stage at Kangiara, near Bowning, New South Wales, see fig. 4*a*, Plate 110, Part XXVI.

E. setosa Schauer. See Plate 158, Part XXXVIII.

E. tereticornis Sm. This occasionally flowers in the broad-leaved (juvenile) stage.

E. tetragona F.v.M. (Quoted by Diels.)

E. trachyphloia F.v.M. See Bailey's proposed form *fruticosa* discussed at Part XLII, p. 43.

E. umbra R. T. Baker. Some of the juvenile leaves very broad, but all rather thin and paler on the underside. Mr. Cambage and I found it fruiting as a dense scrub of 3–4 feet high on the summit of First Point, Kincumber.

E. uncinata Turcz. is one of the species in which the juvenile form of foliage often remains side by side with the mature foliage.

E. vernicosa Hook. f. (S.)

E. viminalis Labill. Beyond the Blue Mountains, New South Wales, *e.g.*, Cox's River to Fish River, Mount Blaxland to Rydal, Sidmouth Valley (all R. H. Cambage and J.M.H.), we have collected this species with fruits and juvenile leaves on the same twig.

Mr. A. D. Hardy figures an example of precocious fruiting amongst resting buds in *E. eugenioides* in Gippsland. He says he has also seen it in *E. obliqua.* I have seen it in *E. eugenioides* in the Sydney district. (*Proc. Roy. Soc. Vict.* xxix (New Ser.), 172, and Plate 13, 2.)

Eucalyptus alpina was grown in the Centennial Park, Sydney, from seeds obtained from the Victorian Grampians, and it is one of the surprises of acclimatisation that it succeeded there admirably. Mr. A. A. Hamilton, in whose care the tree was, informs me as follows :—

> The first buds which appeared developed slowly, and at the end of one year were still diminutive. In the second-flowering season a further set of buds appeared, which behaved in a similar manner to those of the first year, the latter increasing in size, but still remaining unopened. This again occurred in the third year, three separate sets of buds in different stages of development appearing on the plant at the same time. At the close of the third season the first year's buds flowered, and finally fruited nearly four years after the buds first appeared on the plant. At this period there were four distinct phenological stages of floral growth present.

G.—Dominance or Aggressiveness of Certain Species.

This is a subject which has scarcely occupied the attention of Australian foresters yet, or at all events they have rarely written about it.

Some years ago I pointed out to Mr. Gollan, the Superintendent of the Gosford Nursery, New South Wales, a flourishing tree of *E. numerosa* Maiden, in a border adjacent to the boundary fence. A slender species, it seemed to be flourishing as well as any species in the border. I several times during various years visited this tree, because of the personal interest I took in the species.

In 1915 I was present at the dedication of the Strickland Forest, a few miles away, and pointed out to some people the way in which this species (a southern one) was taking possession of a fairly large area of the forest, its spread being far greater than when I had visited the forest a few years previously. I pointed out that this was the first Eucalypt I had known to behave in such an aggressive manner.

I was therefore much interested to read that Dr. L. Cockayne, F.R.S., in his "New Zealand Plants and their Story," gives an example of the aggressive character of a species of Eucalyptus.

> At Waitati, near Dunedin, on the land belonging to the Mental Hospital, stands a fine example of a kind of Stringybark (*Eucalyptus numerosa*), more than fifty-eight years of age. Originally the vegetation of the area was mixed Taxad forest, but this has been replaced by a close growth of Manuka thicket (consisting of various low shrubs). Some years ago this thicket was burned in the neighbourhood of the tree, and a young forest of gums several acres in extent has sprung up, the new ground and the potash from the fire being eminently suitable for the germination of the Gum-tree seeds. In 1910 the Gum saplings

grew extremely closely. Their height was from 40 to 50 feet. Some were half a foot in diameter, while others were extremely slender. Thousands of Manuka (*Leptospermum scoparium*) seedlings sprang up along with those of the Gum; and it must not be forgotten that Manuka, far more than most of the indigenous plants, can reproduce itself again and again after burning, and can exclude almost all other vegetation. But in this case the great rapidity of growth gave the Gums the victory, and eight years ago only a little Manuka remained near the margin of this remarkable and quite natural forest growth.

But this is only one phase of dominance. We want observations, as quantitative as possible, showing the way in which various species attain large size and crowd out or smother other species. The Taxonomic portion of this work now enables foresters to recognise the Eucalypts. These remarks should be read in connection with Coppicing, in Part XLVIII, p. 249, where another phase of Dominance is incidentally referred to.

In the photograph, to be reproduced later, supplied by Mr. C. J. Weston, Afforestation Officer of the Federal Territory, we have a lesson taught, as regards a few species, in a limited area, and it shows how *E. Macarthuri* has dominated certain species.

But what we mainly want are observations in regard to what may be termed the natural dominance of the trees of the forest, in order that this factor may be taken cognizance of in the plans for commercially working the forest.

H.—Natural Grafts.

1. Cohesion of Branches.

See an Appendix entitled "On some Natural Grafts between Indigenous Trees," to my "Forest Flora of New South Wales," vol. vi, pp. 79 and 287. This is based on an earlier paper by me in *Journ. Roy. Soc. N.S.W.*, xxxviii, 36, (1904). Most of the references are to adhesion, not cohesion. I give some cases of true cohesion—that is to say, the branches of only one species being concerned.

See also a fine example of a natural graft in *E. tereticornis* on the original Bathurst, New South Wales, road, between Sidmouth Valley and Rainville Creek. The photograph (April, 1909) is by R. H. Cambage, and is reproduced in my "Forest Flora of New South Wales," vol. vi., p. 287.

In *Vict. Nat.*, xxvii, 207 (1911) is a note by Mr. J. W. Audas, with an excellent photograph of cohesion of branches in *E. elæophora* F.v.M., locally known as "Grey Gum." It is near the Beaconsfield State School, Victoria, and was pointed out by Mr. McCann. The tree is about 15 feet in circumference at the base, and attains a height of about 50 feet. It forks about 10 feet from the ground, and unites again at about 25 feet. After this union four large limbs spread out. The junction is quite 3 feet by 3, and the limbs growing thereon are much thicker than those below the union.

In *Vict. Nat.*, xxxviii, 13, June, 1921, there is a statement by Mr. Audas that he has seen in the Balangum Ranges, Grampians, Victoria, a Yellow Box (*E. melliodora*) and a Grey Box (*E. hemiphloia* var. *microcarpa*), which have different root-systems. The usual circumstance is that the trunks fuse only a few feet from the ground, and,

at a little distance, the tree appears to have a composite trunk with two kinds of bark, and to have two kinds of foliage, as represented by two large branches of the different species concerned.

There is a fine example of this inarching of branches, 12 inches in diameter, in *E. hæmastoma* var. *micrantha* in the Federal Territory, on the Queanbeyan-Uriarra road, near the saddle of Mount Stromlo. Mr. C. J. Weston pointed me out the tree and sent the photograph (February, 1920), which will be subsequently reproduced.

There is another illustration of cohesion of branches in the figure of *E. rostrata* by A. D. Hardy, Plate XI, *Proc. Roy. Soc. Vict.*, xxix (New Series), 167 (1916).

"An excellent instance of fusion of shoots (post-genital) was observed in the case of *E. salmonophloia*; two cross-bars occurred, one close above the other; a very rare case." ("Principles Plant Teratology," Worsdell, i, 118).

It will be observed that all the Eucalypts quoted are Gums, or, if rough barked on the trunk, with smooth branches. In an allied genus, *Angophora*, *A. lanceolata* is perhaps the commonest tree in Eastern Australia to show the phenomenon, and that is a smooth bark also. In the case of the rough barks, it is fair to suppose that the fusion took place at an early stage of the plant's history, before the rough bark had developed.

"Naturally grafted branches are fairly common on Beech, Oak, Holly, Lime, Willow, Yew, and Scots' Pine, whilst they may also be noted on many other trees." ("Natural Grafting of branches and roots," by W. Dallimore, *Kew Bulletin*, 1917, p. 303). Mr. Dallimore discusses the way in which this grafting has been brought about in certain cases. Speaking of the friction between two branches, caused by the wind, he points out that a good deal of tissue may be destroyed, and all the time nature is trying to repair the injury by forming patches of callus on both branches, at those places where friction is least active. As the branches become heavier and movement ceases, the patches of callus grow together, and eventually a strong union is effected between the two branches. The paper is suggestive, and should be referred to.

2. Adhesion of Branches.

Under Cohesion of Branches," at p. 279, I have quoted a paper from my pen, and it will be seen that the Natural Grafts there enumerated are vastly more numerous in the case of Adhesion, *i.e.*, where two different species (and more rarely, genera) are concerned. I will content myself with a few supplementary notes.

Following is a relatively early reference to natural grafts. "If nature does not admit of crossing in the genus *Eucalyptus*, it certainly encourages that of grafting, for, in the neighbourhood of Mudgee, the Apple (*Angophora intermedia*) may be grafted naturally on *E. rostrata*, whilst, on the Richmond Common a similar eccentricity may be seen on *E. tereticornis*." (Rev. Dr. Woolls in *Proc. Linn. Soc. N.S.W.*, xvi, 61, 1891.) I have not seen the reputed Mudgee graft, but that on the Richmond Common was a false graft, in other words, no graft at all. See my "Forest Flora of New South Wales," vol. vi, p. 79.

See also a natural graft between *E. obliqua* and *E. viminalis* at Turritable Creek, Macedon, Victoria, reported by A. D. Hardy. (*Proc. Roy. Soc. Vict.*, xxix, (New Series), 166.)

Mr. A. D. Hardy also gives a case of heterotropy (reversed direction of growth of branch), in the form of a drawing of a branch of a reputed hybrid of *E. hemiphloia* × *melliodora*, between Stawell and the Grampians, Victoria. (Plate 12, *Proc. Roy. Soc. Vict.*, xxix (New Series), p. 169.)

There was also reported to me as a natural graft *E. maculata* (Spotted Gum) (this was green) and *E. paniculata* (Grey Ironbark) (this was dead). The trees were at Cessnock, New South Wales, and the observer, Mr. F. G. McPherson, District Forester, Wyong, New South Wales. I have a photograph, but in view of the death of the Ironbark the graft does not appear to have been perfect, and it is probably one of the so-called false grafts, *i.e.*, where one tree grows in another, the latter being a sort of container or flower-pot.

The late Dr. G. V. Perez, of Teneriffe, who died in January, 1920, was a man whose work was admired by horticulturists throughout the world. He took the liveliest interest in Australian plants. Amongst others he cultivated *E. ficifolia* and *E. calophylla*. Following are extracts from some of his latest letters, and which refer to adhesion of branches (grafting by approximation, approach, inarching, are more or less synonymous terms, though in strictness, inarching only takes place when scion and stock are growing on their own roots).

In order to preserve a very beautiful Eucalyptus hybrid, which I am growing from seeds sent from Sydney as *E. ficifolia* (cherry-coloured) (this is *E. calophylla* var. *rosea*.—J.H.M.), I am grafting by approximation, placing the stock in a large and long bamboo; the method succeeds very well, and I should say that to preserve any pretty shade of colour it will be valuable. I am going to employ as stock the hybrid *calophylla* x *ficifolia*, as *E. ficifolia* is much more delicate in the bad soil I have here, and besides the "Cherry" I wish to preserve is a hybrid, which does not breed true from seeds; I have thought that what I have written may possibly be of some interest. (31st March, 1919.)

I shall now endeavour to obtain several plants of one which you sent as *E. ficifolia*, and which is certainly a hybrid, often referred to in my correspondence with you as "Cherry" colour (*calophylla* var. *rosea*.—J.H.M.), and most beautiful and floriferous, which began to flower when only four years old, and the progeny of which began to flower as early as two years old, some of them being white, some resembling the parent plant, and some rosy-pink (on Mendelian lines probably.—J.H.M.). The colour is so beautiful that it is worth while preserving by grafting by approximation, by the method above named, and grafting on its own stock; I have already two successfully grafted and planted out, but on (?) true *ficifolia*, which is not such a good stock.

. . . . with reference to what I wrote about grafting *E. ficifolia* by approximation in large and long true bamboo tubes, allow me to add that a small tree grafted in this manner, and which is only about half a yard high, and which has only been in the ground about one year, is about to flower; its parent, the seeds of which were sent by you, is of a beautiful fire or orange colour, and I presume it is the true *ficifolia*, which, according to you, is often of this colour. (18th June, 1919).

In my last letter I alluded to a tiny Eucalyptus which I had grafted by approximation; it has flowered. It is of the fire or orange kind. If there is any novelty about this kind of grafting of coloured Eucalyptus to preserve the pretty kinds, perhaps you would like to know that it has been a most successful way of grafting in my hands; I first grow the stock in a long and large true bamboo tube, and attach it to the tree I wish to graft on and propagate. (5th July, 1919.)

J.—Artificial Grafts.

1. Budding and Grafting.

I do not know of any successful Australian experiments with adult Eucalyptus plants. In a few cases I have heard of experiments being made, but they have usually been abandoned before completion of the experiment.

Following is an account of some experiments by French horticulturists :—

M. Felix Sahut gives a remarkable account of a Eucalyptus which, planted at Lattes in 1864, resisted 32 degrees Fahr. of frost during the memorable winter of 1870–1, nor did the tree suffer in any way, and even its leaves remained intact. It had been raised from a seedling among seed of *E. Risdoni*, and its identity was never traced. It grew to a height of nearly 40 feet during its comparatively short life, for at the age of twenty years it gradually began to show signs of weakness, and ultimately it died.

This tree, which had been provisionally named *E. Lattensis* by M. Naudin, indicated a species possessing cold-resisting qualities, but as it never blossomed, M. Sahut's foresight led him to graft it on an allied species, with the view to its cultivation as an ornamental tree in more northern parts of France.

Two methods were employed, one, the cleft graft, with moderate results only, and the graft by approach, or inarching, with much greater success. The stock being more susceptible to cold than the scion, the operation was purposely made as near as possible to the root. The union of the plants was practically perfect, and five or six dozen plants developed vigorously and with great promise. Some of them grew to a height of 6 feet during the first year, but during the next season they all began to fail, and at the end of the third year not one was alive.

The operation of budding was not tried by M. Sahut in these experiments, because he did not think it would succeed, and it is interesting to note that this method has been adopted with good results elsewhere. The *Revue Horticole* published, in 1893, an account of work of this character conducted in Palestine by M. Justin Dugourd, who budded *E. globulus* on *E. resinifera*. The former species is one with spreading roots, and is less resistant to the influence of the wind, &c., than the latter, which was used as the stock, because it grows into a strong tree.

It appears to be necessary for the complete success of this operation to support the scion in some suitable manner, so that the sap may the more readily reach it. As the stock increases in growth it is also desirable to remove any shoots which it may produce, unless the operation is unsuccessful, when the subject may then be allowed to grow. (*Gard. Chron.*, 11th March, 1899, p. 145.)

2. Grafting by approach in the Seedling stage.

This operation may be either cohesion or adhesion, and it leads to such important and, perhaps, practical results, and therefore is worthy of brief consideration under a separate heading.

Grafting by approach in Eucalyptus is easy when the plants are little past the cotyledon stage, according to some experiments by Mr. C. J. Weston, Afforestation Officer, Canberra. In practice they sometimes result in pans of mixed seed, two diverse seedlings being accidently pressed together by the fingers in the operation of potting up.

In the nursery rows at Canberra are three sturdy plants of *E. rubida-maculosa*. When I saw them in July they were about 3 feet high, and spreading. One half of each plant has the typical *rubida* character, and the other half of the plant the typical *maculosa* character. Stripping the soil from the roots shows perfect fusion of the two trees. This grafting by approach or fusing of two species by pressure applied at a critical time could also hardly be avoided by the agency of animals treading amongst young seedlings.

I published the above note in *Journ. Roy. Soc. N.S.W.*, liii, 21, (1919), as I thought Mr. Weston's experiments should be put on official record. An illustration will be furnished in due course.

Here, I think, is the key to the most perfect case of fusion or adhesion I have ever seen in my life, viz., that brought under my notice by Mr. Chappelow of a White Gum and a Stringybark illustrated (as regards a section of the timber) in my paper, *Journ. Roy. Soc. N.S.W.*, xxxviii, 36 (1904). See also my "Forest Flora of New South Wales," vi, 79. It seems to me much more likely that so complete a fusion of two species would take place at a very early stage of the existence of the two plants than by the rubbing together of woody stems or branches later on. As Eucalyptus trees are increasingly grown artificially in Australia, we may expect to see more of these grafts originating in the potting shed. Perfect natural grafts of the Chappelow type are exceedingly rare, and it seems to me that my theory of fusion as young seedlings by the trampling of native animals or of stock is worthy of consideration.

K.—Fasciation.

Fasciation of branches is not common in Eucalyptus, or at all events it must be rare, for I have not come across a record. A case of fasciation in young suckers of *E. gracilis* was sent to me from Lake View, Griffith, Line 61 (N.S.W.) by Mr. W. D. Campbell, L.S., in 1918.

L.—Tumours and Galls.

The literature on this subject, as regards Eucalyptus, is very scant. Not only the most important paper but almost the only one, is "On certain shoot-bearing Tumours of Eucalyptus and Angophoras, and their modifying influence on the growth habit of the plants," by J. J. Fletcher and C. T. Musson, in *Proc. Linn. Soc. N.S.W.*, xliii, 191, with many plates.

They quote Clayton O. Smith, "Further Proof of the cause and infectiousness of Crown Gall" (Univ. California Publications, *Agric. Experim. Station Bull.* No. 235, December, 1912), as the first to draw attention to the fact that the stem-nodules in a certain species of Eucalyptus are axillary, and that certain stem-nodules arise from infection by soil-bacteria. "In Eucalyptus seedlings the natural knots often appear opposite each other where the cotyledons have previously attached, also the Quince knots appear first at the node about the old leaf-scar. All the evidence we have goes to show that some injury or weakness is necessary for infection to take place."

Clayton O. Smith, *op. cit.*, p. 549, published the figure (21) which will be duly reproduced. The legend is "Artificially caused galls on forest Red Gum (Eucalyptus *tereticornis*). Crown gall has not been known to attack the various species of Eucalyptus

in nature. The significance of swellings found frequently at the crown of young Gum trees is not yet understood. They do not appear to be detrimental to the tree." A further note on this crown gall will be found at p. 552 of the work quoted.

Forest Red Gum (*Eucalyptus tereticornis*). Fig. 21. Seedlings of 4 to 6 feet were inoculated. The first successful inoculations were made May 16, 1910. On March 25, 1912, there was one large knot and one very small one at points of inoculation. September 2, 1911, inoculated a seedling about ½ inch in diameter. February 20, 1912, there were two small knots. On March 26, 1912, one of these knots had grown rapidly in size, the other had not changed.

Inoculations were made on small seedlings July 29, 1910, on the branches. Typical roundish knots or galls had developed on September 5, 1910.

The appearance of a Eucalyptus nodule (or rather a pair of axillary stem-nodules still unfused) may be seen in the figure of one in *E. paniculata*, see fig. 12, Plate 57, Part XIII of the present work.

Fletcher and Musson (p. 198) say :—

Were it not that, by a fortuitous combination of circumstances, the axillary stem-nodules are able to fuse in pairs, the fused pairs to concresce, and the reinforced, composite, stem-encircling tumours thus enabled to incorporate roots, and so last for some considerable time, or even permanently, both the nodules and any shoots they might develop would be short-lived and abortive, as they actually are in refractory seedlings, and as the shoots on the lower pairs of concrescences also are. . . .

But in the natural inoculations in the lower axils of the young seedlings of Eucalypts, which furnish some of the most valued hardwood timbers, we are inclined to think that the organisms are confined to the out-growths, and the circling tumours to which they give rise, and probably do not invade the tissues of the seedlings. The tumours do not kill the seedlings, or even seriously damage their tissues. They are a drag on the normal development of the plants, especially so when shoots do not develop, and by interfering with the water-supply, and also by their shoots preventing the development of the normal branching. In the Mallees, so much water is intercepted by the tumours that the seedling-stem is dwarfed; and, by the persistence of the shoots, the growth habit is permanently distorted, so that the plants are prevented from realising their potentialities as trees. The seedling-stem may possibly be sometimes crowded out and got rid of. But the stem-nodules, as well as the composite tumours to which they give rise, are complex tumours, composed of both somatic cells and germ cells; and the latter are totipotent, because in the persistent-composite tumours of the Mallees, the tumour-shoots complete their growth, flower and fruit, and produce seed. Even in the non-Mallees, if the seedling-stem is lost, two tumour-shoots may take its place, attain to tree-size, and flower and fruit. But they do not prematurely disclose their embryonic possibilities in the way that some of Erwin Smith's artificially-produced monstrosities did. Also, the production of these tumours in Eucalyptus under natural conditions is a matter of long standing. The Mallee scrubs, which must have been the development of centuries, were in their prime when civilised man first saw them, nearly 101 years ago.

Then follow a number of interesting references to Mallees, arranged in chronological order, particularly as regards the "root"—the "Mallee-roots" which form an important portion of the fuel supply in South Australia and those portions of Victoria and New South Wales adjacent thereto.

The authors (pp. 204, 228) state that they have met with six species of Eucalypts exempt from tumours or stem-nodules, viz., *E. oreades* R. T. Baker, *E. pilularis* Sm., *E. sp.* (from foot of Blue Mountains, New South Wales, on the western side), *E. gigantea* Hooker, *E. regnans* F.v.M. var. *fastigata*. I hope the paper will direct the attention of Australians to phenomena which have only been imperfectly studied as regards

the morphology of the widely distributed tumours or galls themselves, and which could only have been studied as to causation since the development of the science of bacteriology.

During the last twenty-five years at the Botanic Gardens, Sydney, and at the auxiliary State Nursery, Campbelltown, I have caused to be raised many thousands of Eucalyptus seedlings for distribution to public institutions. The number of species grown at Campbelltown is relatively small, but at Sydney (chiefly for the colour-drawings of seedlings by Miss Flockton for many years, and latterly by Miss Ethel King, an enormous number of species, perhaps 150, has been grown from time to time, and in many cases these have been kept in pots for years until pronounced mature leaves made their appearance. In course of time, research students will continue or promote the good work of Messrs. Fletcher and Musson, and I hope that the enormous wealth of nodule material to which I have alluded (and which is far in excess of any material of the same kind I have ever heard of) will be used for study.

The following brief bibliography concerning galls in plants other than Eucalyptus may be suggestive. It chiefly refers to the dreaded Crown Gall, which works such devastation in economic plants:—

Bulletin 213, on "Crown Gall of Plants; its cause and remedy" (Bureau of Plant Industry, U.S. Dept. Agric., 1911).

"Chemically induced Crown Galls," by Erwin F. Smith (*Proc. Nat. Acad. Sciences*, Washington, iii, 312 (April, 1917)). "A fuller account, accompanied by photographs and photo-micrographs, will be published in the *Journal of Agric. Research*." See also Abstract in "Current Opinion" (Philadelphia) for March, 1918, p. 193.

"Plant Cancer," *Missouri Bot. Garden Bull.*, May, 1919, p. 51. A useful short article, with a few illustrations and some bibliography.

In "The Garden" for 12th July, 1873, is a brief article, with a remarkable illustration, on "Swollen-stemmed Irish Yews." The specimens, bearing large tuberous bodies between the stem and the proper roots, were obtained from cuttings. The plants were generally under 2 feet in height, while those of normal growth, of the same age, averaged about 5 feet; all, however, having the same healthy appearance. The tubers averaged from 8 to 12 inches in circumference, with a ligneous structure throughout, but showing large annual rings or growths, and covered with bark, having numerous roots proceeding from the under surface.

Mr. E. Breakwell, B.A., B.Sc., has very kindly given me a memo., which has been reproduced with little alteration and few additions, in the following statement.

Bulbous and tuberous stems may be caused either by (1) insect invasion, forming galls, (2) fungus invasion, (3) xerophytic conditions, and (4) qualitative influence of correlation.

(1) *Insect invasion.* See Goebel's "Organography of Plants," Part I. Goebel points out that galls are due either to a material excreted from the unfertilised, or

from the fertilised egg, and that the material may be the same in both cases, or in some cases by a larval stimulus. The protection to the insect in the gall is effected partly mechanically, partly chemically—especially by a copious formation of tannin—but the protection is not absolute. He emphasises two points—

(*a*) In general no tissue elements appear in the anatomical structure of the gall which do not exist elsewhere in the plant under other conditions.

(*b*) All the more highly differentiated galls are produced out of juvenile tissues caused to develop in an abnormal way by gall insect. The more complex the gall is, the earlier must the influence producing it be exerted on the plant tissues.

(2) *Fungus invasion.* See *Annals of Botany*, vol. xxiv, p. 537, July, 1910, by T. Reed. The writer points out that Bernard discovered, by inoculating the cortex of the roots of young plants of *Solanum tuberosum* with the spores of the fungus *Fusarium*, he produced a greater yield of tubers than if not artificially inoculated. This means that although the stem is removed from the roots, the former becomes infected. Bernard tentatively suggests that the fungus may thus operate by giving rise to soluble products which in some mysterious way cause the underground stems to swell up and accumulate vast reserves of carbohydrates, &c.

"The roots of *Podocarpus* are covered with small tubercles formed by a *Mycorrhiza*, which probably assists in the nutrition of the plants, especially when young. ("The Flora of South Africa" (Marloth), i, 103, with fig.)

(3) *Xerophytic conditions.* See Warming—"Aecology of Plants," p. 124. Bulbous and tuberous plants are mainly confined to Liliaceæ, Iridaceæ, Amaryllidaceæ, and other families growing in dry countries, particularly in South Africa. Many tubers consist of root and stem combined, as in the case of some shrubs in the South American savannahs.

(4) *Qualitative influence of correlation.* Goebel, "Organography of Plants," Part I, p. 215, points out that if a certain part of a plant be affected (by wounding, *e.g.*) other parts will be affected. Knight produced tubers from aerial roots, by removing the subterranean stolons at an early period or by interfering with their connection with the aerial parts. He produced tubers on the top of the aerial shoots, the points furthest separate from the normal position of *formation* of tubers.

M.—Protuberances of the Stem.

In reply to a correspondent, I intimated that the matter of reserves of liquids in trees is principally in the Apple Tree (*Angophora*), a genus closely allied to Eucalyptus. It is also found in a number of Eucalypts. It arises through the irregular shrinkage of the rings of timber, and these get more or less filled with gum—or kino is a more correct term—and when shrinkage proceeds further, being sometimes helped by bush fires,

these cavities may cause shelling; if they proceed further they are large enough to fill a bucket. As a rule, these cavities contain liquid more or less astringent, because of the presence of the kino of which I have just spoken. In the case of the Cider Gum of Tasmania (*E. Gunnii*), the liquid is watery and so little astringent that it can be drunk. In many cases the liquid gets into the cavity through lodging in the fork of the tree or trickling through a crack of the wood. To some extent this watery liquid would be added to by the sap, but I think that the quantity of that is negligible. There is no evidence that the liquid benefits the tree or otherwise. It is not a disease; it is simply an evidence of mechanical shrinkage of the timber. Some of the Bloodwoods (*E. corymbosa* and allies) have the cavities mainly filled with kino.

I have referred to this phenomenon of swollen stems, often liquid retainers, at some length in Part lxiii, p. 119, of my "Forest Flora of New South Wales," in regard to the following species:—*E. Gunnii*, *E. maculosa*, *E. Raveretiana*, *E. Bancrofti* *E. redunca* var. *elata*, and *E. salmonophloia*. I have briefly referred to these swellings in *E. redunca* var. *elata* at pp. 94, 95, Part XXXIV of the present work.

"Swellings and knobs are frequently largest just where it springs from the ground." See A. W. Howitt's remarks concerning *E. polyanthemos* at Part XLII, p. 59, of the present work.

It may be observed that all the above species have smooth or almost smooth barks.

In many cases the butt of *E. coriacea* forms a huge protuberance at the ground level, taking on a peculiar plastic appearance often seen in the coast districts in *E. maculata* (Spotted Gum) and *Angophora lanceolata* (Smooth-barked Apple). In *E. coriacea*, from this protuberance there spring out as many as four (and even more) stems of equal diameter, such stems being equidistant from each other, or nearly so.

N.—Abortive Branches (Prickly Stems).

The presence of abortive branches in Eucalyptus is very common. It is often noticed by rubbing one's hand down a stem when one feels the friction of short sharp prickles. Sometimes these are more or less concealed by the fibrous bark; in the case of Gums they may be quite evident to the eye.

I have been in touch for some years with Mr. Harry Hopkins, of Bairnsdale, Victoria, in regard to this phenomenon, in the beginning in regard to *E. Consideniana*, and I obtained the following useful note (which incidentally deals with other matters) through him:—

Mr. W. H. Harvey, Yarram Yarram, Victoria, who calls this tree "Prickly Messmate," obligingly gives me the following information concerning its occurrence in that State. "It is very scarce, is only found in small belts, chiefly in the parishes of Willung and Carrajung. The tree thrives best and creates a fine barrel or bole in volcanic soils or chocolate loams, when it attains a height of about 50 feet in barrel, and up to 3 feet in diameter. Called 'Prickly Messmate,' on account of the surface of the sapwood being covered as a rule with spikes or prickles. Has a yellowish-brown fibrous bark, and the surface is smoother

(less prickly to the touch) than either Stringybark or Messmate. Wood-buff colour, fairly free from gum-veins, and very durable. Mr. J. Wills, Chief Clerk of Works, Alberton Shire, speaks very highly of this timber, and says that it gives as good results as any timber in the district." (*Journ. Roy. Soc. N.S.W.*, li, 448, 1917.)

Mr. Hopkins writes :—

But I may state that during several years' experience at "bush work" in my younger days, I not infrequently came upon this feature, in both young and old trees of several species, but perhaps mostly in Gippsland in Red Gum (*E. tereticornis*), and to a lesser extent in Stringybark (*E. eugenioides*) and Messmate (*E. obliqua*). I have also seen it in Peppermint (*E. radiata*), Apple Box (*E. Stuartiana*), and *E. rubida*. There is no *Considenìana* in the district where I then was. Generally—I think always, in my experience—the trees showing the characteristic grew upon "wet" ground, with a clay retentive subsoil near the surface, though not actually swampy. In some trees—particularly in the Red Gum—these prickles extended through all the concentric layers of wood, from the outside to almost or quite the centre—in cases where the prickles were largely and well developed, and in some cases, more particularly the Peppermint and Stringbark, the prickles were much smaller, though perhaps very numerous, and appeared to have developed in the outer layers of the wood. In some cases I have seen the surface of the sapwood so closely covered with fine or small prickles that it might be described as articulate or papillous. This condition is certainly not confined to *E. Considenìana*. It may, I think, be found in any species of the Eucalyptus where the causes that produce it are present.

Mr. W. F. Blakely says they are very common in the Orange district, New South Wales, in *E. hemiphloia* var. *albens*, where they are known as "pimples." I have seen them in a number of other species, but regret I have not made a list of them and of their prevalence.

Mr. C. E. Lane-Poole, speaking of *E. Todtiana* (the coastal Blackbutt of Western Australia) says it is disregarded by the houseswife for firewood on account of its many prickles.

E. Planchoniana is sometimes known as "Needle Bark," because it is prickly to rub down with the hand. The name "Porcupine Stringybark" is also applied to it for the same reason.

These prickles, which will probably be found in most species, if looked for, will be illustrated by photographs if specimens in *E. Muelleriana* and *E. tereticornis*, as supplied by Mr. Hopkins.

O.—Pendulous Branches.

It is very difficult to group species according to habit. Besides the question of size, there is that of length of branches, and of canopy. Most species are rather erect in habit, but some, of which *E. sepulcralis* F.v.M., of South Western Australia, is an extreme form, have pendulous branches, and we have all stages between the two. In this species the branches are intensely glaucous and so very drooping and extremely pendulous that it is known locally as "Weeping Gum," and Mueller has suggested its cultivation in cemeteries.

In this and the following species the branches are so elongated, thin, and pendulous, as to droop in an almost vertical manner. *E. macrorrhyncha* F.v.M., a Stringybark of inland eastern Australia; *E. sideroxylon* A. Cunn., an Ironbark of much the same range; *E. Mitchelliana* Cambage, of Mount Buffalo has much the same habit; *E. acaciaeformis* var. *linearis*, a so-called Peppermint of New England, has also markedly drooping branches. *E. coriacea* sometimes has branches so pendulous as to be known as Weeping Gum.

P.—Vertical Growth of Trees.

This subject is touched upon in Part XLVI, p. 123, of my " Forest Flora of New South Wales," based on a paper by Mr. R. H. Cambage in " The Surveyor " (the official organ of the Institute of Surveyors of New South Wales) for 31st December, 1904, and 28th February, 1905.

A further paper from Mr. Cambage's pen will be found in *Journ. Roy. Soc. N.S.W.*, lii, 377, and *Eucalyptus parviflora* is used illustratively. An abstract of this will be found in " The Australian Forestry Journal " for November, 1919, p. 353.

The subject is interesting to many people, because living Eucalypts are often used as corner or other posts in fencing, and if as growth proceeded the rails mortised into the tree were carried up and two panels of fencing injured, it is probable that living trees would cease to be used for the purpose, and would be destroyed forthwith. Mr. Cambage's experiments bear out the observations of people interested in fencing, that the mortise-holes remain at the same height from the ground as when they were made.

Explanation of Plates (200-203).

PLATE 200.

E. drepanophylla F.v.M.

1*a*. Twigs with flower buds; 1*b*, three views of an anther. Port Denison, Queensland (John Dallachy). The type.

2*a*. Juvenile leaf; 2*b* and 2*c*, two leaves, nearly mature and mature; 2*d*, buds and flowers. Mount Elliott, Queensland (J. Fitzalan). Labelled *E. drepanophylla* by Mueller.

3*a*. Long mature leaf; 3*b*, leaf, bud, and flowers; 3*c*, three views of an anther; 3*d*, small globular fruits the tips of the valves slightly exsert. Eidsvold, Queensland (Dr. T. L. Bancroft). I look upon this as a transit form between *E. drepanophylla* and *E. crebra*.

4*a*. Two views of an anther; 4*b*, 4*c*, panicles of fruits. Stannary Hills, North Queensland (Dr. T. L. Bancroft). I look upon these specimens also as showing transit between *E. drepanophylla* and *E. crebra*.

5*a*, 5*b*. Juvenile leaves. Mount Perry, Queensland (J. L. Boorman).

6*a*, 6*b*. Juvenile leaves grown in the Botanic Gardens, Sydney, from seed, from Eidsvold, Queensland (W. F. Blakely).

PLATE 201.

E. leptophleba F.v.M.

1*a*. Juvenile leaf; 1*b*, small juvenile leaf; 1*c*, intermediate leaf; 1*d*, mature leaf; 1*e*, buds and flowers; 1*f*, fruits. Stannary Hills, North Queensland (Dr. T. L. Bancroft).

PLATE 202.

E. Dalrympleana Maiden.

1*a*. Broad juvenile leaves; 1*b*, pointed buds; 1*c*, twig with buds and flowers; 1*d*, fruits. Tumberumba, New South Wales (W. A. W. de Beuzeville). The type.

2*a*, 2*b*. Juvenile leaves of various widths, but most of the specimens available certainly broad. Chimney Pot Hill, Hobart, Tasmania (L. Rodway). These are probably, but not certainly, *E. Dalrympleana*.

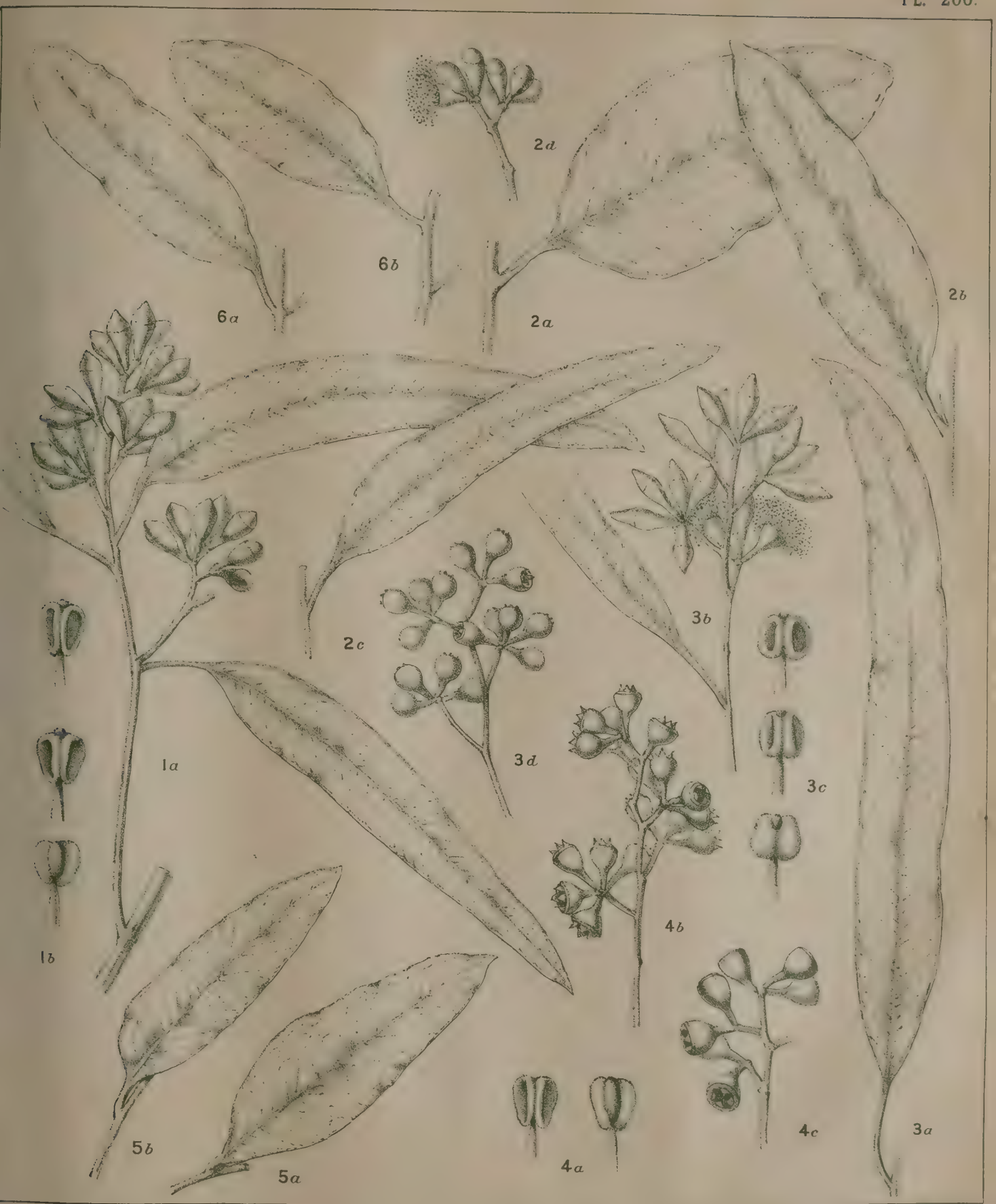
E. dichromophloia F.v.M.

3*a*. Juvenile leaves in the earliest stage; 3*b*, juvenile leaf, further advanced; 3*c*, a coarse leaf in the intermediate stage; 3*d*, a large, speckled fruit. Old Battery, Eidsvold, Queensland (Dr. T. L. Bancroft).

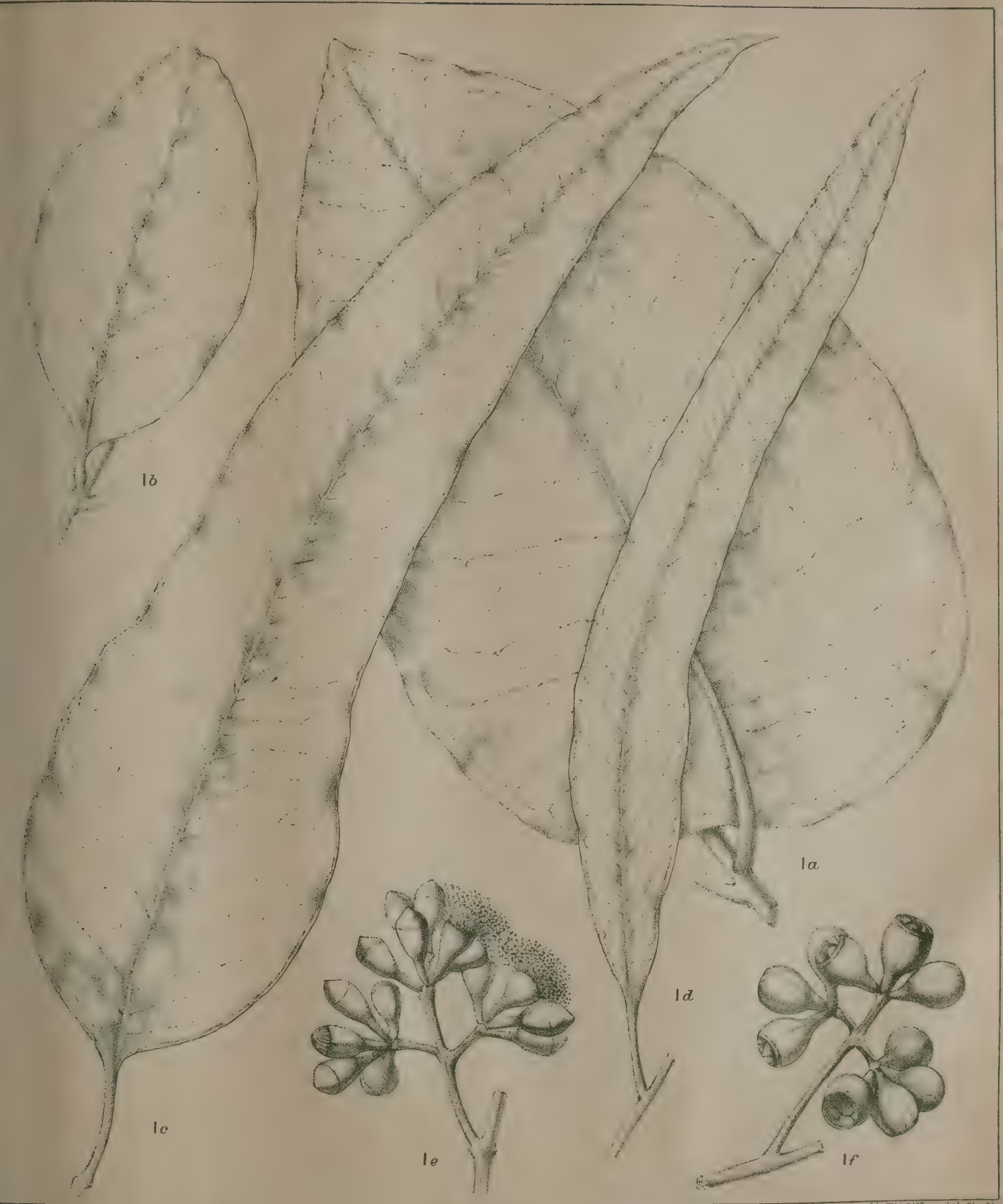
PLATE 203.

E. Hillii. Maiden.

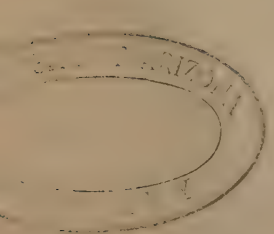
1*a*. Juvenile leaf; 1*b*, 1*c*, intermediate, almost mature leaves; 1*d*, twig with buds and very early fruits; 1*e*, three views of an anther. Bathurst Island, Northern Territory (Gerald F. Hill). The type.

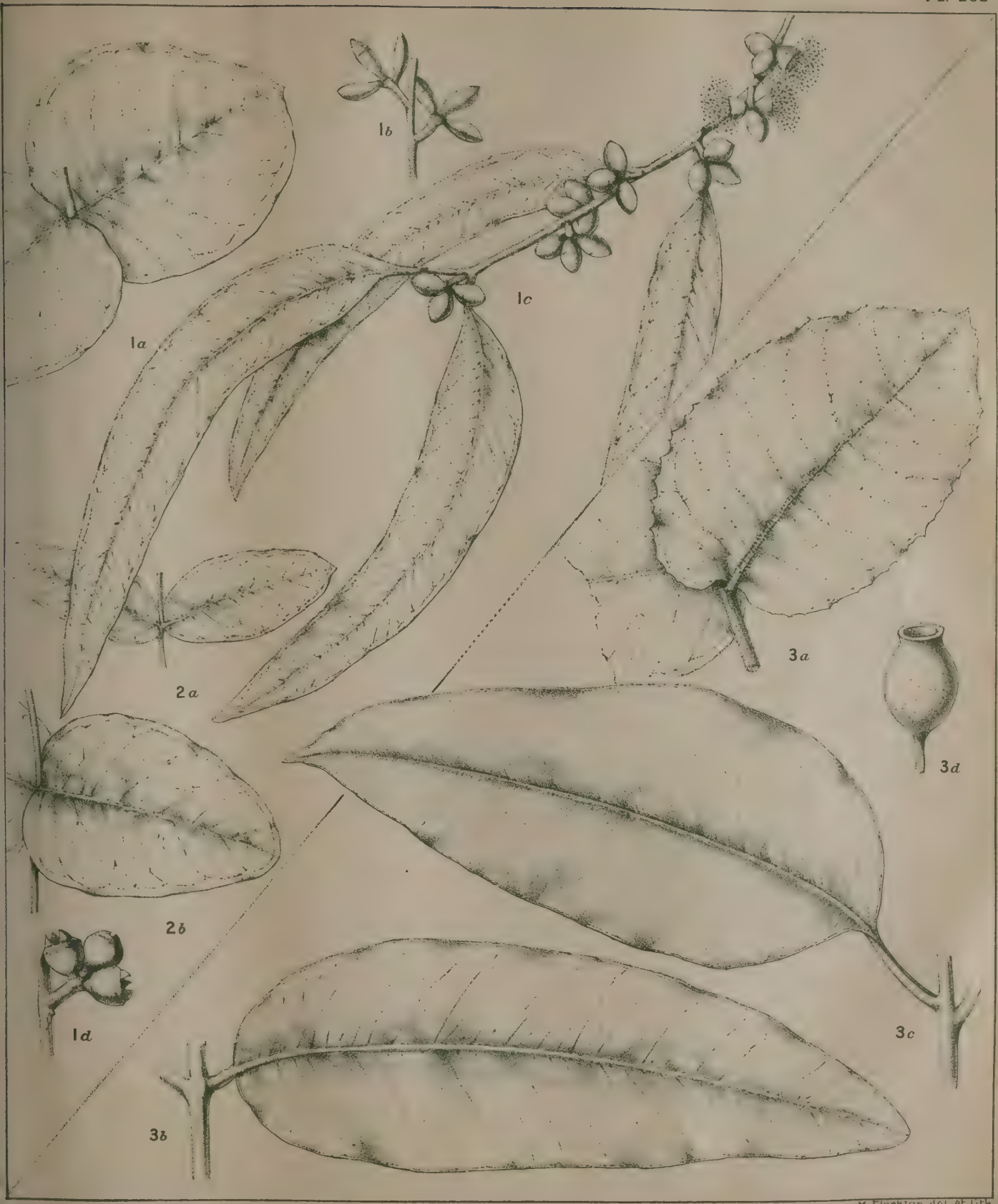


EUCALYPTUS DREPANOPHYLLA F.v.M.

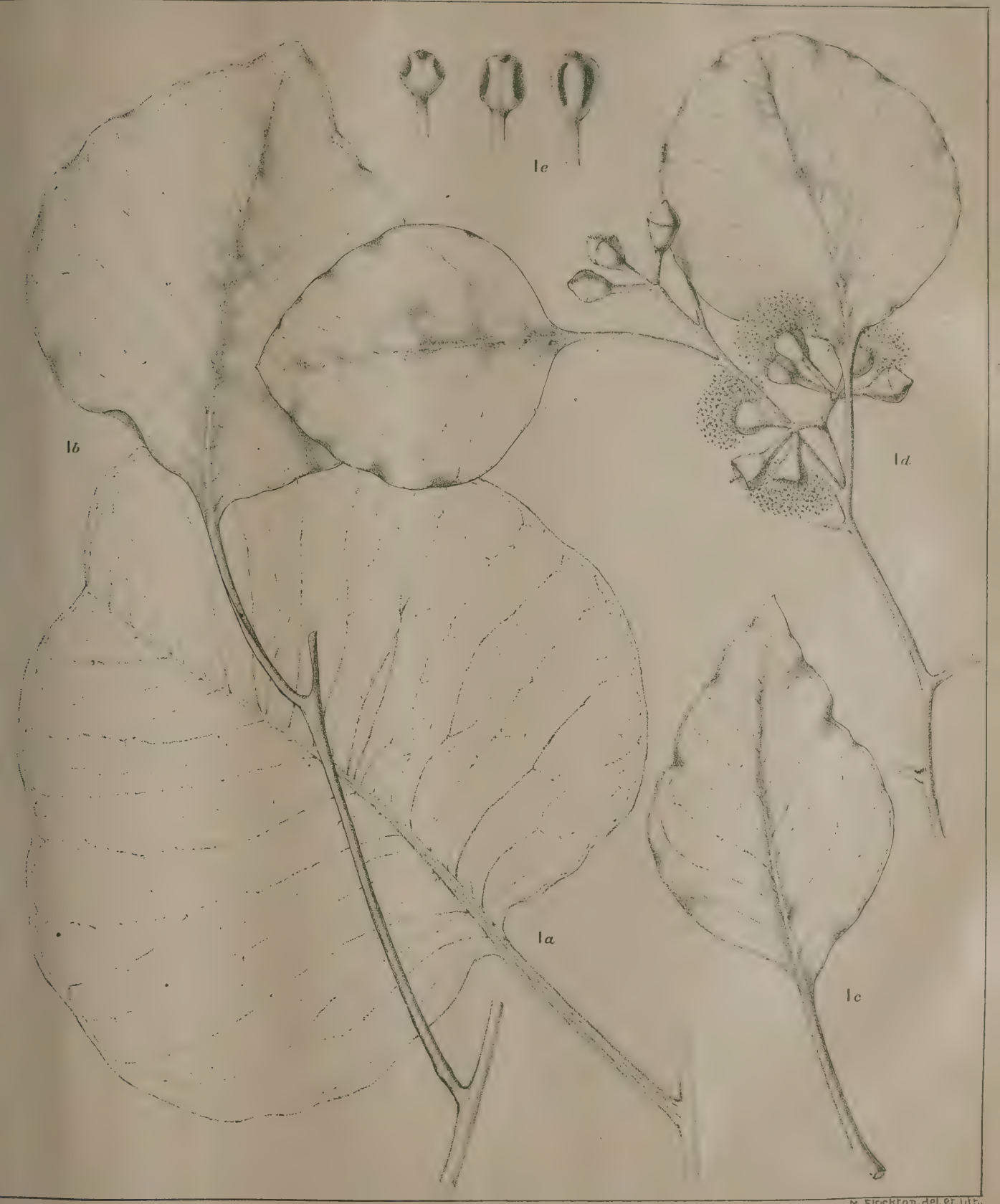


EUCALYPTUS LEPTOPHLEBA F.v.M. (See also Plate 48, Figs. 3-5.)

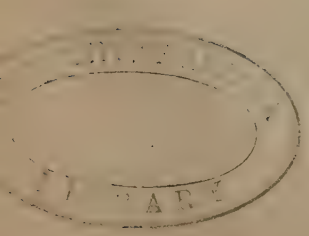




EUCALYPTUS DALRYMPLEANA MAIDEN (*1, 2*).
EUCALYPTUS DICHROMOPHLOIA F.v.M. (*3*).



EUCALYPTUS HILLII MAIDEN.



The following species of Eucalyptus are illustrated in my "Forest Flora of New South Wales,"* with larger twigs than is possible in the present work; photographs of the trees are also introduced wherever possible. Details in regard to their economic value, &c., are given at length in that work, which is a popular one. The number of the Part of the Forest Flora is given in brackets :—

acacicides A. Cunn. (xlviii).
acmenicides Schauer (xxxii).
affinis Deane and Maiden (lvi).
amygdalina Labill. (xvi).
Andrewsi Maiden (xxi).
Baileyana F.v.M. (xxxv).
Baueriana Schauer (lvii).
Baueriana Schauer var. *conica* Maiden (lviii).
Behriana F.v.M. (xlvi).
bicolor A. Cunn. (xliv).
Boormani Deane and Maiden (xlv).
Bosistoana F.v.M. (xliii).
Caleyi Maiden (lv).
capitellata Sm. (xxviii).
conica Deane and Maiden (lviii).
Consideniana Maiden (xxxvi).
coriacea A. Cunn. (xv).
corymbosa Sm. (xii).
crebra F.v.M. (liii).
Dalrympleana Maiden (lxiv).
dives Schauer (xix).
dumosa A. Cunn. (lxv).
eugenioides Sieber. (xxix).
fruticetorum F.v.M. (xlii).
gigantea Hook. f. (li).
globulus L'Her. (lxvii).
goniocalyx F.v.M. (vi).
hæmastoma Sm. (xxxvii).
hemiphloia F.v.M. (vi).
longifolia Link and Otto (ii).
Luehmanniana F.v.M. (xxvi).
macrorrhyncha F.v.M. (xxvii).
maculata Hook. (vii).
melanophloia F.v.M. (liv).
melliodora A. Cunn. (ix).
microcorys F.v.M. (xxxviii).
microtheca F.v.M. (lii).
Muelleriana Howitt (xxx).
numerosa Maiden (xvii).
obliqua L'Hérit. (xxii).
ochrophloia F.v.M. (l).
odorata Behr and Schlectendal (xli).
oleosa F.v.M. (lx).
paniculata Sm. (viii).
pilularis Sm. (xxxi).
piperita Sm. (xxxiii).
Planchoniana F.v.M. (xxiv).
polyanthemos Schauer (lix).
populifolia Hook. (xlvii).
propinqua Deane and Maiden (lxi).
punctata DC. (x).
radiata Sieb., as *amygdalina* (xvi).
regnans F.v.M. (xviii).
resinifera Sm. (iii).
rostrata Schlecht. (lxii).
rubida Deane and Maiden (xliii).
saligna Sm. (iv).
siderophloia Benth. (xxxix).
sideroxylon A. Cunn. (xiii).
Sieberiana F.v.M. (xxxiv).
stellulata Sieb. (xiv).
tereticornis Sm. (xi).
tessellaris F.v.M. (lxvi).
Thozetiana F.v.M. (xlix).
viminalis Labill. (lxiv).
virgata Sieb. (xxv).
vitrea R. T. Baker (xxiii).

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* Government Printer, Sydney. 4to. Each part contains 4 plates and other illustrations.

NOTE BY GOVERNMENT PRINTER.

War conditions have so largely affected publications that it is no longer possi le to continue the issue of "The Forest Flora of New South Wales" at the old rates, and from this date onward, *i.e.*, from and including Part 7, Vol. VII, the price of the individual Parts will be raised to 2s. 6d. each.

For those Parts already published the old sale price will be adhered to, and subscriptions already received will not be disturbed, but the new subscription rate of 2s. 6d. per part, or 25s. for 12 parts, will come into effect as from the 1st July, 1921.

Sydney: William Applegate Gullick, Government Printer—1921

A Critical Revision of the genus Eucalyptus

BY

J. H. MAIDEN, I.S.O., F.R.S., F.L.S.

(Government Botanist of New South Wales and Director of the Botanic Gardens, Sydney).

Vol. V. Part 10.

Part L of the Complete Work.

(WITH FOUR PLATES.)

"Ages are spent in collecting materials, ages more in separating and combining them. Even when a system has been formed, there is still something to add, to alter, or to reject. Every generation enjoys the use of a vast hoard bequeathed to it by antiquity, and transmits that hoard, augmented by fresh acquisitions, to future ages. In these pursuits, therefore, the first speculators lie under great disadvantages, and even when they fail, are entitled to praise."

MACAULAY'S "ESSAY ON MILTON."

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•26863—A

1921.

CCLXXXVI. Eucalyptus Mundijongensis Maiden.

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Affinities 306

No. II. The Bark.

(Continued from p. 289, Part XLIX.)

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a. True Mallees 323
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DESCRIPTION.

CCLXXXI. E. Houseana (W. V. Fitzgerald) Maiden.

In *Journ. Royal Society*, N.S.W., xlix, 319 (1915).

FOLLOWING is the original description :—

Arbor alta, altitudinem 80 feet attinens, aetate opposito-foliata florescens. Folia juvenia fere amplexicaulia, petiolis brevibus vel absentibus, latissime lanceolata ad fere ovata, basi cordata, apice obtusa, pallida saepa glauca, 8–12 cm. longa, 6–7 cm. lata. Venae patentes, venis principis fere parallelibus, margine crassata. Folia matura petiolata, alternata, falcata, petiolis 2 cm. longis, foliis ad 16 cm. longis et 4 cm. latis. Alabastri, pedunculis brevibus leniter planis, floribus sessilibus vel fere sessilibus, 4–7 capitulo. Operculum hemisphaericum circiter dimido cupula subangulare aequilongum. Antherae aperintes in fissuris parallelibus, versatiles, dorso glandula magna. Fructus non vidimus.

" Amongst the tallest of the tropical species, occasionally reaching a height of 80 feet."

Particulars as to habit, bark, and timber, not available.

[The following is supplementary information from Mr. Fitzgerald's MSS. " Height 40–70 feet, trunk to 30 feet, diameter 1½–2½ feet, bark persistent, white to greyish-white, smooth; timber reddish, not very hard or tough.—Quoted by Maiden in *Journ. Roy. Soc. N.S.W.*, li, 450, 1917.]

Juvenile leaves.—The following description has been drawn up from specimens in the flowering (or rather plump bud) stage; they represent, as far as we have them at present, the juvenile leaf stage; at the same time, they are mature to the extent that they are contemporaneous with the inflorescence. Opposite, almost stem-clasping, the petioles being very short or absent; very broadly lanceolate to nearly ovate, cordate at the base, apex blunt pointed, margin sometimes undulate, pale coloured, or entirely glabrous. Length 8–12 cm., width 6–7 cm.

Venation spreading, the principal veins roughly parallel, and making an angle of approximately 60 degrees with the midrib ; the margin thickened, the intramarginal vein well removed from the edge, the venation distinct, particularly on the lower surface.

[From additional material collected by Mr. Fitzgerald, the following additions to the description have been drawn up :—

Juvenile leaves.—Slightly glaucous, equally green on both sides, slightly stem-clasping around a nearly terete branchlet, oval to ovoid or broadly-lanceolate, tapering into a blunt or rounded apex, up to 18 cm. (say 7 in.) long by 8 cm. (say 3⅛ in.) broad, secondary veins roughly parallel, at an angle of about 60 degrees with the midrib and with abundance of fine anastomosing veins, the intramarginal vein well removed from the edge.—Maiden in *Journ. Roy. Soc. N.S.W.*, li, 450, 1917.]

Mature leaves.—(Petiolate, alternate, lanceolate, falcate, with petioles of 2 cm., and leaves up to 16 cm. long and 4 cm. wide. Venation distinct, the foliage pale-coloured and glabrous and the two surfaces scarcely to be distinguished from each other.)

Flowers.—Buds with short, slightly flattened peduncles, the individual flowers sessile or almost so, four to seven in the head as seen. Opercula hemispherical, about half the length of the calyx-tube, which tapers only slightly, and which is usually sub-angular. (Filaments turn red on drying. Anthers open in parallel slits, attachment of filaments versatile, large gland at back.)

Fruits not seen.

[Fruits conoid to hemispherical, small (rather more than 5 mm. in diameter), nearly sessile, the short broad pedicel continued into the calyx-tube, forming two or more angles. Peduncle of 5 to 7 mm., also flattish and angular. The fruit with a narrow rim, the tips of the capsule slightly exsert and not adnate to the edge. Description drawn up from material collected by Mr. J. H. Niemann at Pine Creek, Northern Territory, and given by me in *Journ. Roy. Soc. N.S.W.* li, 450, 1917.]

Type.—Isdell River near Mount Barnett Homestead, Kimberleys, North Western Australia, No. 1014, collected by W. V. Fitzgerald, May, 1905.

The sentences in round brackets ( ) have been drawn up from specimens (No. 1357) collected at the base of the Artesian Range, Kimberleys, by Mr. Fitzgerald. The sentences in square brackets [ ] have been drawn up from the sources stated.

In the following year (viz., 1916) Mr. Fitzgerald, on the eve of his departure for the war, placed certain of his botanical manuscripts in my care, and I found the following description of this species amongst them, which supplements, to some extent, my original description :— .

Arborescent, branchlets angular; leaves on the young plants opposite or sub-opposite, shortly petiolate, ovate-cordate, obtuse, those on the tree alternate, conspicuously petiolate, broad to narrow-lanceolate, usually falcate, acuminate, all thin, of dull lustre, the oil dots copious, veins fine, numerous, ascending and evident, reticulated between, intramarginal one adjacent to the edge; flowers 4–8, sessile and rather closely packed, on axillary and lateral thick terete peduncles which are much dilated upwards; calyx-tube obconical, not ribbed; lid depressed, hemispherical, much shorter than the calyx-tube; stamens inflected in the bud; anthers oblong, with parallel distinct cells dehiscing longitudinally; ovary flat topped; style short.

Leaves (Juvenile) 3–4 inches long, (Mature) 6–8 inches long, the petioles to 1 inch. Peduncles 2 lines long; calyx-tube 2 lines or less in length. Stamens 2 lines, the filaments white.

Fruit not seen.

Locality.—On grassy plains, Upper Isdell River, base of Artesian Range (W.V.F.). The species is named in honour of Dr. F. M. House of Western Australia.

Affinity.—*E. fœcunda*, Schauer.

RANGE.

It is a tropical species occurring both in Western Australia and the Northern Territory.

Western Australia.—The type comes from Mount Barnett Homestead, Kimberleys, North West Australia (W. V. Fitzgerald, No. 1,014)—" In swampy and wet sandy localities, associated with the coarser kind of grasses were *E. Houseana* and *E. ptychocarpa.*" (Fitzgerald in " Kimberley Report," p. 12).

Appendix.—The name *Houseana* was used by Mr. Fitzgerald in the *Western Mail*, Perth, W.A., of 2nd June, 1906. No description of the plant was ever published. A small scale photograph was accompanied by the following words :—" *Eucalyptus Houseana* W.V.F., after Dr. F. M. House, is among the tallest of the tropical species, it occasionally reaching a height of 80 feet. This tree usually occurs on well-grassed plains between the Isdell and Charnley Rivers (original description, p. 322)."

Northern Territory.—I attribute the following four specimens to this species :—

1. Scientific Expedition of Prof. (now Sir) W. Baldwin Spencer (and others) from Darwin to the Roper River, Gulf of Carpentaria, July–August, 1911. At Cullen Creek Prof. Spencer collected a specimen with glaucous foliage, twigs and buds. Leaves sessile but hardly stem-clasping; flowering while the leaves are still opposite. The leaves as much as 15 cm. long and half as broad.

Then I have three specimens from the Pine Creek Railway, viz. :—

2. Collected by Dr. H. I. Jensen, Government Geologist, Darwin, in August, 1913. His label reads, " Sessile leaf, white bark (? smooth bark—J.H.M.), small flower and fruit (no fruit available—J.H.M.), rather crooked branches." Close to type.

3. A similar specimen from E. J. Dunn, Pine Creek Railway, same date, also in bud and leaf.

4. Specimen in leaf, bud, and flower from Pine Creek, J. H. Niemann, August 1904. This differs from the type, and Nos. 2 and 3, in having distinct pedicels to the flowers. There is a slight umbo to the operculum, probably because the bud is fully developed. The leaves are mostly narrower-lanceolate than the type, and most have distinct, though very short, petioles. (Original description, p. 320).

In Ewart and Davies' " Flora of the Northern Territory," p. 311 (1917), I quoted the following additional localities :—

381. Burrundie (McKinlay River flats).

359. " Snow-white bark, smooth-barked tree, growing singly or in branches like Mallee. Medium size. It is crooked on poor soil, straighter on Burrundie alluvial soil." Burrundie.

345. " Particularly partial to flooded clay flats. Like many trees it loses its leaves in the dry season." Pine Creek.

379. " Tree up to 40 feet high, smooth white bark." On flats, Pine Creek to Wandi.

375. Wandi. Non-glaucous.

380. Mount Diamond to Wandi Flats.

413. Umbrawarra.

Dr. Jensen says that the forms from the hills and from the flats may look very different, which may be due to a stunting of the former, which have a much smaller leaf and fruit.

AFFINITIES.

This is another of the few species which flower in the opposite-leaved or juvenile stage (See *Journ. Roy. Soc. N.S.W.*, xlviii, 424 (1914)). If described from the type only, it might have been looked upon as homoblastic species, but the additional material I have quoted shows that, like *E. praecox* (*loc. cit.*), it is heteroblastic, like the vast majority of species of this genus. We can only say that it is an example of retarded heteroblasty.

Other instances of retarded heteroblasty in Eucalyptus are :—

E. Risdoni Hook. f. See Plate 32 of the present work.

E. Gillii Maiden. See Plate 67, *op. cit.*

E. cinerea, F.v.M. See Plate 89, *op. cit.*

E. cinerea F.v.M., var. *multiflora*. Plate 90, *op. cit.*

E. melanophloia F.v.M.

In the absence of a complete suite of specimens and full data as regards *E. Houseana*, I am only able to suggest relationships to the following species at present :—

1. With *E. alba* Reinw.

The flower-buds of *E. Houseana* may resemble those of *E. alba* a good deal. Exceptionally the leaf-blade may resemble that of *E. Houseana* in shape and venation, but that of *E. alba* is not sessile at any stage, not cordate at the base, and is often gross in size. Speaking generally, the foliage of *E. alba* is not pale-coloured, whether arising from glaucousness or not. Both species flourish in moist, low-lying localities.

2. With *E. clavigera* A. Cunn.

It differs from this species in the hairiness of the leaves (particularly) in young specimens, so common in *E. clavigera*, in the numerous flowers, in the great length of the peduncles and pedicels, and in the clavate shape of the buds of *E. clavigera*. The shape of the leaves and the venation may, exceptionally, be a good deal similar in the two species. (Original description, p. 321.)

3. With *E. fœcunda* Schauer, according to Mr. Fitzgerald himself.

E. fœcunda is figured and described in Part IV. I am not able to indicate close affinities, and leave the matter for further enquiry.

DESCRIPTION.

CCLXXXII. E. Jutsoni Maiden.

In *Journ. Roy. Soc. N.S.W.*, liii, 61 (1919).

Following is the original description :—

Frutex parvus ramulosus circiter 6–8 altus, trunco tenue. Ramulorum apicibus planis mox teretibus. Foliis maturis brevissime petiolatis, angusto-linearibus, 7·5–9 cm. longis, crassis, duris venis inconspicuis. Pedunculis brevissimis vel absentibus 2–4 floris; calycis tubo conoideo operculo acuminato conoideo æquilongo. Antheris *E. angustissimæ* similibus. Flores non vidimus.

"A small, thin-stemmed, branching-from-the-root-gum, about 6 to 8 feet high on the average. White flowers, yellow pointed buds. Ants very numerous on the bark" (J. T. Jutson). Branchlets flattened at the tips, but soon becoming terete.

Juvenile leaves not seen.

Mature leaves very shortly petiolate, narrow linear, acuminate, slightly twisted, 7·5–9 cm. (say 3–3½ inches) long, wiry, thickish and tough, the veins inconspicuous, often channelled at the inconspicuous midrib.

Peduncles axillary, very short or absent, flattened, each with two to four flowers.

Buds sessile or tapering into a short, flattened pedicel-like process, the calyx-tube conoid, and of the same length as the acuminate conical operculum.

Flowers.—Stamens inflected in the bud, anthers renantheroid (*i.e.*, somewhat resembling the Renantheræ), and apparently similar to those of *E. angustissima*. Style long, the stigma scarcely thickened, the ovary conical.

Fruits not seen.

Type from Comet Vale, W.A. (John Thomas Jutson, No. 216. Formerly Geological Surveyor on the staff of the Geological Survey of Western Australia.)

RANGE.

It is only known from Comet Vale, a township on the railway line 63 miles north of Kalgoorlie, Western Australia.

AFFINITIES.

1. With *E. angustissima* F.v.M.

Its closest affinity appears to be with the imperfectly known *E. angustissima*. See the present work, Part XIX, with Plate 84.

E. Jutsoni appears to be a coarser plant than *E. angustissima*, and its conoid or tip-cat buds are quite different in shape to those of fig. 7*a*, which has very short, though distinct, non-tapering pedicels. Fruits of 8*b*, as depicted, could not result from the flowers of *E. Jutsoni*. The anthers of the two species may not be dissimilar, but I have not seen ripe ones of *E. angustissima*. After the most careful consideration I am quite satisfied that, although the two species present some points of resemblance, they are distinct.

2. With *E. oleosa* F.v.M., var *angustifolia* Maiden.

This is a narrow-leaved form of the species, figured at fig. 17, Plate 65 (the type), with other specimens referred to this form, viz., fig. 18, Plate 65, and fig. 1, Plate 66, with figs. 2 and 3, Plate 66, perhaps belonging to it.

The type of var. *angustifolia*=*E. socialis* F.v.M., and it differs from *E. Jutsoni* in the broader, more distinctly veined leaves, and in the number of flowers in the head. Incidentally it may be pointed out that the buds figured at fig. 1b, Plate 66, display great similarity to those of typical *E. angustissima* (fig. 6*a*, Plate 84).

DESCRIPTION.

CCLXXXIII. E. adjuncta Maiden.

In *Journ. Roy. Soc. N.S.W.*, liv, 167 (1920).

FOLLOWING is the original description :—

Arbor alta, "Grey Gum," ligno atro-rubeo. Foliis maturis petiolatis lanceolatis, rectis vel falcatis, venis secundariis patentibus non prominulis. Alabastris axillaribus, umbellis 3-floris in duobus paribus, pedunculis pedicellisque gracilibus, calycis tubo obconico, operculo rostrato 1 cm. longo. Fructibus hemispherico-conoideis, ca 1 cm. diametro, calycis tubo læve margine distincta, capsulæ valvis valde exsertis.

A tall tree of 70 or 80 feet, with a diameter of 3 or 4 feet (Andrew Murphy); the bark smooth, and somewhat rough in patches, like that of a Grey Gum; timber deep red.

Juvenile leaves.—What are known as "suckers" (adventitious shoots) are not available, but a young seedling has leaves of medium width.

Mature leaves small (as far as the material is available), petiolate, lanceolate, straight or falcate, tapering gradually to the apex, without lustre, secondary veins not prominent, spreading, the midrib and marginal vein pink in colour.

The original material was mislaid. When subsequent search was made for the original trees it was found that the group of three had been destroyed in the widening of the line, and others have not yet been found. The belated description is published now, in the hope that other trees may be traced.

Buds axillary, usually in two pairs of three flowered umbels, peduncles slender, 1 cm. long and more, decurved, pedicels slender, of half that length, calyx-tube smooth, obconical, 5 mm. long, 7 mm. broad, terminating somewhat abruptly in the pedicel; operculum rostrate, 1 cm. long. Anthers long, white, opening in parallel slits, gland at back, versatile.

Fruits hemispherical-concoid, about 1 cm. in diameter, calyx-tube smooth, with distinct domed rim, the valves of the capsule three or four and well exsert.

RANGE.

Close to the bank of a fresh-water creek, near the eastern side of the railway line, about three-quarters of a mile from Wyee Railway Station, towards Morisset, Wyee is 71 miles north of Sydney, and 33 miles south of Newcastle, New South Wales.

The species has been temporarily lost, so we must postpone further notes as to its range. It has probably been confused with other Grey Gums in well-watered littoral districts of New South Wales and Queensland.

AFFINITIES.

Its position seems to be between *E. longifolia*, Link and Otto, and *E. punctata* DC., but to come nearer to the former. The timber seems to be nearer *E. longifolia* in texture and colour, although that of *E. punctata* runs it closely. As regards the bark, while *E. punctata* is consistently a Grey Gum, one may have logs showing that the woolly bark (woolly-butt) of *E. longifolia* almost disappears, showing bark intermediate between a Grey Gum and a Woolly-butt. *E. adjuncta* is a Grey Gum.

1. With *E. longifolia* Link and Otto.

For *E. longifolia* see Part XX, Plate 86, of the present work. There is similarity in the pink veins of the leaves and in the three-flowered umbels and in the timber. There are differences in the larger leaves of *E. longifolia*, in the (as a rule) smaller flowers, in the absence or almost absence of exsertion of the valves and in the roughness of the bark.

2. With *E. punctata* DC.

Originally *E. adjuncta* was sent as a " bark and timber not to be distinguished from *E. punctata*." For *E. punctata* see Part XXIX, Plates 121, 122, of the present work, where it will be seen that the peduncles and pedicels are thicker, the flowers are more numerous in the umbel, the buds different in shape, and the fruits different.

DESCRIPTION.

I. E. pilularis Sm.

Following is the original description of a variety :—

E. pilularis Sm., var. *pyriformis* Maiden, in *Journ. Roy. Soc., N.S.W.*, xlvii 94 (1913).

Bucca Creek, near Coff's Harbour, New South Wales. (A. H. Lawrence, J. L. Boorman.) Type, J. L. Boorman, June, 1911.

A tall, sound "Blackbutt," 4 to 7 feet in diameter, bark ribbony up to beyond the third or fourth branches. Bark on the butt similar to that of the normal species. Branchlets often glaucous and double opercula common.

Fruit large, often pyriform, commonly 1·5 cm. long, 1 cm. broad in the dried state.

Since the above was published I have obtained the following additional particulars from Mr. Boorman :—"Tall trees of 60–80 feet. Timber straight in the grain. On the hills away from Bucca Creek on the Woolgoolga road near Coff's Harbour. Only a few trees in the district."

At one time I thought this might be a species distinct from *E. pilularis*. It differs from the normal species in the size and shape of the fruits. I have, however, since obtained some fruits which are nearly as globular as those of normal *E. pilularis*. The glaucous branches in the variety seem different. The juvenile leaves of both forms seem to be the same. It is certainly an interesting variety.

For a reference to aboriginal names of normal *E. pilularis* see Part I, p. 27, also a paper by me in *Agricultural Gazette, N.S.W.*, October, 1903, p. 989.

DESCRIPTION.

CCLXXXIV. E. pumila Cambage.

In *Proc. Roy. Soc. N.S.W.*, lii, 453, 1918 (with Plate XXXVII).

FOLLOWING is the original description :—

Arbuscula alta, cum truncis multis separatis, in altum pedes quindecim viginitive extendens, trunci diametrum unciarum duarum triumve habens.

Ramusculi angulares præcipue ad extremitates.

Folia (reversio) tenera ovata ad ovata-lanceolata, 3–5 cm. longa 1–1·5 cm. lata.

Folia matura linearia-lanceolata ad ovata-lanceolata, modice crassa, sex ad duodecim cm. longa, unum ad tria cm. lata, sæpe leviter falcata; utrobique obtuse viridia, extremitates fuscæ et flaccide, systema venosa modice clara, venæ laterales angulis cir. circiter 40 ad 55° e corta media dispositæ, vena inter margines plerumque juxta marginem, olei glandulæ numerosæ. Petiolus 1–1·5 cm. longus.

Gemmae.—Fuscæ cum colore viridi tinctæ, proper sessiles vel cum pediculis circiter unum mm. longis, operculum conoide, quinque ad septem mm. longæ, calycistibus vix longitudinis dimidius pedunculus, aliquanto complanatus circiter unum mm. longus.

Flores.—Circiter septem ad tredecim in umbella, antheræ modicæ callæ parallelæ.

Fructus.—Prope sessiles, hemisphericales, diametrus circiter septem mm. plerumque cum quatuor valvis exsertis, ora crassa, convexi.

Cortex.—Tenuis et levis ad humum, interdum cum vittis pendulis longis, crassus ·5–2 mm., color cinereus vel subviridis.

Lignum.—Fuscum in centrum, durum.

A tall shrub of many separate stems reaching 15–20 feet high, with stem-diameter of 2–3 inches.

Branchlets.—Angular, especially towards the tips.

Juvenile (reversion) FOLIAGE.—Ovate to ovate-lanceolate, 3–5 cm. long, 1–2·5 cm. broad.

Mature leaves linear-lanceolate to ovate-lanceolate, fairly thick, 6–12 cm. long, 1–3 cm. broad, often slightly falcate, dull green on both sides, tips brown and withered. Venation fairly distinct, lateral veins arranged at angles of from about 40–55 degrees with the midrib, intramarginal vein usually close to the edge. Oil glands numerous. Petiole from 1–1·5 cm. long.

Buds.—Greenish-brown, almost sessile or with pedicels about 1 mm. long, operculum conoid, 5 to 7 mm. long, the calyx-tube scarcely half that length, peduncle somewhat flattened, about 1 cm. long.

Flowers.—About 7–13 in the umbel, anthers of medium size, the cells parallel.

Fruits.—Almost sessile, hemispherical, about 7 mm. in diameter with usually four exserted valves, rim thick, convex.

Bark.—Thin and smooth to the ground, sometimes ribbony, ·5–2 mm. thick, slaty to greenish in colour.

Timber.—Brown towards centre, tough.

Seedlings.—*Hypocotyl* red, erect, glabrous.

Cotyledons slightly emarginate, 1·7 mm. long, 5 mm. broad, lobes oblong-obtuse, upper side green, underside red, glabrous; petiole 2 mm. long.

Seedling foliage opposite for two or three pairs, entire, glabrous, oval-lanceolate to ovate and ovate-lanceolate, obtuse. First pair up to 1·4 cm. long, 7·5 mm. broad, upperside green, underside red to purple, petiole 2 mm. long. Second pair up to 3 cm. long, 1·8 cm. broad, underside red to purple, petiole 5 mm. Third pair up to 4·7 cm. long, 2·4 cm. broad, underside at first reddish purple, becoming pale green, petiole up to 7 mm.

Stems red.

The seeds germinated twelve and a half years after being gathered. Plants when about 6–8 inches high developed nodules or swellings about the axis of the cotyledons, which had fallen.

RANGE.

Near Pokolbin, a quarter of a mile west of portion 146, Parish of Rothbury County of Westmoreland, New South Wales.

This species is a Mallee growing on the side of a hill amongst *Eucalyptus siderophloia* Benth., *E. maculata* Hook., *Callitris calcarata* R.Br., *Casuarina Luehmanni* R. T. Baker, and *C. stricta* Ait. The specific name is in allusion to the dwarfed habit of the tree.

AFFINITIES.

1. With *E. dealbata* A. Cunn.

Its closest affinity appears to be with *E. dealbata* A. Cunn., from which it differs in bark and timber, as well as the texture of the leaves, and the position of the intramarginal vein. The seedling foliage is also different. (The evolution of the Eucalypts in relation to the cotyledons and seedlings, by Cuthbert Hall, M.D., *Proc. Linn. Soc. N.S.W.*, vol. xxxix, Plate 46). *E. dealbata* will sometimes grow in Mallee form, but in such cases the bark remains fairly thick, and the timber soft.

2. With *E. Behriana* F.v.M.

In bark, timber, oil and habit *E. pumila* much resembles *E. Behriana* F.v.M., but differs in the flowers, fruits and leaves.

Leaves of this Eucalyptus were procured and distilled in August, 1907, at the Technological Museum. Messrs. Baker and Smith report on the oil as follows :—

The yield of oil is large, 617 lb. of leaves with terminal branchlets giving 9 lb. 10 oz. of oil—equal to 1·56 per cent. The oil is very rich in eucalyptol, and both in yield and eucalyptol content this species is one of the best from which to distil Eucalyptus oil for pharmaceutical purposes, and in this respect may be associated with *E. Smithii*, *E. polybractea* (*fruticetorum*) *and E. Morrisii*. The oil contains some

pinene, but the dextrorotatory form only slightly predominates, and consequently the large fraction of rectified oil does not vary but slightly in optical properties from that of the crude oil. This is contrary to the general experience with oils of the eucalyptol class, as in those the dextrorotatory pinene generally predominates. There are only a few species which give an oil, the rectified portion of which has a less dextrorotatory than the crude oil; *E. dealbata* is one of the species having this peculiarity as well as *E. Behriana*, *E. maculosa*, and a few others. No phellandrene could be detected. A small amount of the lower boiling aldehydes was present; the odour indicated that butaldehyde and valeraldehyde were present, thus following the general rule. The crude oil in appearance and other characteristics resembles those of this group generally, and the recified oil is slightly tinted yellow. . . . Of the most closely allied oils it more nearly approaches *E. dealbata* than that of any other species which has yet been investigated, although the resemblance between it and the oil of *E. Behriana* is also strongly marked.

Being a Mallee, it was thought that it might contain a considerable amount of calcium oxalate in the bark. The green bark taken from small sticks had a thickness of 1 to 2 millimetres; it was found to contain 3·85 per cent. of calcium oxalate. The amount of calcium oxalate in the bark of the largest piece having a diameter of 3 inches was 5·39 per cent. The crystals in the bark of this species differ in no respects from those of Eucalyptus barks generally (see paper with plate by H. G. Smith in *Journ. Roy. Soc. N.S.W.*, xxxix, 23, 1905). The amount of lime in the bark of *E. dealbata* was 1·19 per cent.

DESCRIPTION.

CCLXXXV. E. rariflora F. M. Bailey.

In *Queensland Agric. Journ.*, January, 1914, p. 62, with plates.

Following is the original description :—

A tall tree not recorded as very abundant; branchlets slender of a pleasing red colour. Leaves very variable in shape, those of the flowering branchlets varying from lanceolate to oblong or even ovate, from 2–4½ inches long and ½–1 inch broad, or the ovate ones still broader on slender petioles of about 1 inch. On young trees the leaves are almost orbicular, or sometimes obversely reniform, and mostly broader than long, but always slightly decurrent on the petiole from ½–3 inches long and ½–3½ inches broad, apex sometimes emarginate, texture thin, in the young leaves, almost membranous. (The petioles in these large leaves are often over 2 inches long.) Parallel nerves numerous, slender, branching at the top, where they join the intramarginal one, which is sometimes very close, at other times rather distant from the edge, the smaller veins forming a very delicate irregular reticulation. Oil dots numerous. Inflorescence composed of slender erectopatent panicles of usually few scattered pedicellate flowers; at times in umbels of three or four flowers. Operculum very short, scarcely exceeding 1 line, blunt or very slightly umbonate. Stamens inflected in the bud, the outer ones 1½ lines long. Anthers globular, opening in broad slits. Fruit (including the short pedicel) 4 lines long, about 2 lines diameter; rim rather broad. Capsule sunk, 4-celled, the valves not exserted. Seeds small, somewhat pear-shaped, dark brown and slightly rugose.

The trunk and large branches are (according to information and specimens kindly supplied to me by Dr. T. L. Bancroft) covered with hard-fibrous, black, corrugated bark, such as would merit the name of Black Box (*Rhytiphloiæ*). The colour of the timber is pale brown.

RANGE.

It is confined to Queensland, so far as we know at present, the only specimens known coming from Eidsvold and Mundubbera.

AFFINITIES.

The author was struck by the remarkable shape of the juvenile leaves, but suggested no affinity.

The affinity is with *E. populifolia* Hook., see Plate 48, Part X. There is no doubt that the two species are closely related, and it may be that they belong to the same species. I have received admirable specimens and notes from Dr. T. L. Bancroft, who suggested hybridism, an opinion I held for a number of years, but which I abandoned.

If the references and plates to *E. populifolia* and *E. rariflora* be examined, it will be found that in both species we have a predominance of round or poplar-leaves (*populifolia*), but also lanceolate leaves of various widths. In *E. populifolia* we have the narrower leaves in trees which do not appear to carry the broadest leaves, or which have not been collected on the same tree. In *E. rariflora* we have the two kinds of leaf on the same tree.

These narrow leaves above referred to are shiny and are generally recognised as belonging to *E. populifolia*; indeed, bushmen call the shrub or tree producing them "Narrow-leaved Bimble Box." It is around these narrow leaves that the uncertainty, referred to hybridism as one explanation, has gathered. (For example, I thought the explanation was in assuming a hybrid between *E. populifolia* and *E. bicolor*, the latter being a species often associated with the former, and having narrow leaves.)

The explanation I submit at the present time is that in all these forms we have one comprehensive species, consisting of—

1. *E. populifolia*, with broad leaves, as we usually know it.
2. With lanceolate leaves of various widths.
3. *E. rariflora*, with leaves of (1) and (2) combined on the same tree.

I believe that we have isoblastic and heteroblastic species which are but forms of one another, and that we keep them apart because we have not the connecting evidence.

In the present case I have given the evidence as to leaves; I cannot see any difference in inflorescence and fruits. The barks and timbers appear to be alike. I have given sufficient evidence to cause both Queensland and New South Wales botanists to endeavour to settle a very interesting and far-reaching point as to the relations between, or the identity of, the two species.

DESCRIPTION.

CCLXXXVI. E. Mundijongensis Maiden.

In *Journ. Roy. Soc., N.S.W.*, xlvii, 225 (1913).

FOLLOWING is the original description :—

Arbor alta, Cortex basi trunci dura et secedens. Rami teretes. Lignum pallidum. Folia circiter 15 cm. longa et 2 cm. lata, angusto-lanceolata, leniter falcate, nitentia, concoloria, crassa, coriacea, petiolata, penniveniis parum conspicuis. Alabastri in apicem acutati, clavati. Operculum in apicem acutatum circiter dimidio calycis tubo æquilongum. Flores non vidi. Fructus fere sessiles, cylindroidei, circiter 1·5 cm. longi et ·75 cm. diametro, margine angusta et sulcata. Valvarum apices sub orificio valde depressi.

A tall tree, about 80–100 feet high, and 5 feet in diameter about 4 feet from the ground. The trunk of the only specimen known at present leans somewhat and divides into two main branches of approximately equal diameter at about 25 feet from the ground.

Bark.—"Fine adherent bark at base, top clean" (Dr. Cleland). Specimens of the bark forwarded by Mr. H. M. Giles and also by Mr. Wallace, are hard, flaky, breaking off in long woody strips. Bark of smaller branches smooth, but exhibiting exfoliation. It has a good deal in common with the Peppermint barks of the Eastern States (*e.g.*, *E. piperita*, Sm.).

Timber.—Pale coloured.

Juvenile leaves.—Coarse, thick, coriaceous, moderately shiny, equally green on both sides, petiolate, venation not very prominent, somewhat spreading at the base in some specimens, in others at an angle of about 60° to the midrib, and roughly parallel. Intramarginal vein not conspicuous, and somewhat removed from the edge. Size of leaves seen by me about 12 cm. long and 5 broad.

Mature leaves.—Narrow lanceolar, somewhat falcate, shiny, equally green on both sides, thickish, coriaceous, petiolate, venation inconspicuous and penniveined, margins thickened, and the fine intramarginal vein not close to the edge. Leaves seen by me about 15 cm. long, and 2 broad.

Buds.—Not seen perfectly ripe. Pointed clavate, slightly angular, the operculum pointed, very slightly exceeding the calyx-tube in diameter, and about half as long as the same. Each half ripe bud about 1 cm. long with a pedicel of half that length, apparently three to seven buds in the umbel, with a strap-shaped peduncle of 1·5–2 cm. Flowers not seen.

Fruits.—With short peduncles to nearly sessile, cylindroid, about 1·5 cm. long, and about half that in diameter, with a thin, grooved rim, valves three or four, and the tips well sunk below the orifice.

RANGE.

This is only known at present from one (perhaps two) localities in Western Australia. Following is the history of the species so far as I know it:—

Early in 1909, Dr. J. B. Cleland gave me a photograph of a tree and a few fragments of fruits and leaves from Jarrahdale, Western Australia. His label was "near Jarrahdale. Fine adherent bark at base, top clean. Near Jarrahdale Forest."

I recognised the specimens as identical with leaves and fruits given me by the late Mr. J. G. Luehmann, of the National Herbarium, Melbourne, many years ago when I intended to visit Western Australia, a trip which was postponed. This specimen bore the label, "Close to the inn near Jarrah Dale, about 28 miles from Perth (Sir) John Forrest, 22nd March, 1882."

The locality is near Mundijong Railway Station. I have been in communication with Mr. C. R. P. Andrews, of Perth, on the subject, both before and since my visit to the western State in 1909. Although I planned to visit the tree, and actually got as far as the railway station, I was compelled to return to Perth without inspecting it.

Mr. Andrews kindly communicated with the local teacher, and the following are extracts from two of his letters:—

The teacher (Mr. Stephen Wallace) states that the tree grows about 5 miles from Jarrahdale, and he therefore wrote to Mr. R. Cowen, on whose property the tree stands, for particulars. In forwarding the specimens, Mr. Cowen remarked, "Suckers are not obtainable. As far as I know, the tree is the only one of its kind in the district, and it seems to me to be a great age. The diameter is about 5 feet, and the tree grows on poor shallow soil. The sub-soil is nearly pure pipe-clay, and it is in a very wet place, both in summer and winter. Local opinion generally classes it as a Tuart."

The teacher states that it is a difficult tree to get specimens from, except when high winds blow the branches off. He also states that it appears to be in danger of destruction from white ants.

Mr. Wallace has kindly forwarded small sections of one of the smaller branches and also some twigs at Mr. Andrews's suggestion. For additional material I am indebted to Mr. H. M. Giles, of South Perth.

AFFINITIES.

1. With *E. incrassata* Labill. Mueller suggested this affinity on a label on Sir John Forrest's specimen.

The affinity, or, at all events, the resemblance, is there, no doubt. We have it in the cylindroid fruits, but I know of none quite so cylindrical as those of the present species. As regards the buds, the operculum is shorter than the calyx-tube in some forms of *E. incrassata* also, but there is an absence of multiple ribbing in the present

species. The juvenile leaves are somewhat different and the mature leaves are very different to those of any form of *E. incrassata* I know. The proposed species is a large tree, far exceeding in size that of any form of *E. incrassata* I ever heard of.

2. With *E. gomphocephala* DC.

" Local opinion generally classes it as a Tuart " (correspondent of Mr. Andrews). Figures of *E. gomphocephala* can be seen in the " Eucalyptographia," and at Plate 92, Part XXIV of the present work. The affinities are not close, the swelling of the operculum in *E. gomphocephala* is a very prominent character, and there is only the trace of a swelling observable in the buds of the new species (they are, however, unripe). Occasionally, *e.g.*, at fig. 2*f* of the plate quoted, the rim of the fruit of *E. gomphocephala* may be reduced, in which case the fruit bears some resemblance to that of the new species. But it would appear that the fruit of *E. gomphocephala* always has exserted valves. The resemblance of the leaves is not specially close.

When I get flowers I will again raise the question of the affinities of this tree; in the absence of them, any conclusions must be of a provisional nature.

THE BARK.

(Continued from p. 289, Part XLIX.)

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1. EARLY REFERENCES TO EUCALYPTUS BARKS, AND EARLY EUCALYPTUS VERNACULARS IN GENERAL.

The earliest reference to Eucalyptus trees in the field is by Banks in 1770 (Hooker's "Journal of the Right Hon. Sir Joseph Banks," 1896), but although he and Solander observed them at both Botany Bay and Northern Queensland, their barks do not appear to have attracted his attention. This is not to be surprised at, as, close to the sea, they do not exhibit that degree of variation which is observed further inland. Apart from that, his visit was but a flying one, with the nature of the country, its aborigines, its fauna, its plants, all most puzzlingly strange.

> Mr. Caley [George Caley was in New South Wales from 1800 to 1810.—J.H.M.] has observed in the limits of the colony of Port Jackson nearly fifty species of Eucalyptus, most of which are distinguished, and have proper names applied to them, by the native inhabitants, *who, from differences in the colour, texture, and scaling of the bark* [the italics are mine], and in the ramification and general appearance of these trees, more readily distinguish them than botanists have as yet been able to do (Robert Brown in Flinders' "Voyage to Terra Australis," ii, 545, 1814).

In the same work (i, 18) Robert Brown had already stated—

> Of Eucalyptus alone nearly 100 species have been already observed; most of these are trees, many of them are great, and some of enormous dimensions. . . .

But only fourteen species were known to science in 1814, and only six species are referred to by Brown in his Collected Works (Ray Society).

Hooker's Eulogium (*Proc. Linn. Soc.*, 1888, pp. 56–7), says:—

> Now, Brown, in the appendix to Flinders' "Voyage" says that he collected nearly 4,000 species (3,900) in Australia . . . The species were, in a great measure, at any rate, described as collected in Australia itself, the descriptions were written out in the homeward voyage, and it only remained on the return to England to complete the work.

It seems impossible that he excluded the Eucalypts. I have referred to the matter in my "Sir Joseph Banks," p. 42.

If Caley or Brown made notes on the bark, they have not been preserved (or at all events, they have not been seen by an Australian specialist in the genus); from men of their powers of observation the notes could not fail to have been of interest. The aborigines of the districts in which Caley worked are practically extinct now. It is scarcely possible they abstained from making notes on such a difficult and interesting subject. We know that Caley brought specimens of timbers to England ("A series of specimens of the native woods collected in New Holland by the late Mr.

George Caley," and presented to the Linnean Society, *Trans. Linn. Soc.* xvii, 597 (1832) have disappeared, and, probably, losing their labels, have long since been destroyed). Even a manuscript list of Caley's (if it exists), describing the barks of New South Wales trees, would be worthy of perusal, for year by year, we can interpret such notes better.

Dr. A. R. Rendle, Keeper of Botany, British Museum, has kindly given me original labels with some of Caley's specimens, and I have given notes on them, *e.g.*, *E. eximia*, Part XLII, p. 30.

The first reference I can find to the use of the term "Gum Tree" is "The Red Gum-Tree (*Eucalyptus resinifera*)" in White's "Voyage," p. 231 (1790). It had evidently got into use, for we have "The Red Gum-tree" in G. Barrington's "History of New South Wales," p. 461 (1802). The term arose without reference to the bark, but to the Kino or "gum" which exuded from the tree.

As early as "Gum" we have the name "The Peppermint tree (*Eucalyptus piperita*)" in White's "Voyage," p. 226 (1790). This also did not refer to the bark, but to the leaves, which were early distilled for medicinal purposes for local use. See p. 328, Park LXVII of my "Forest Flora and New South Wales."

The words "White Gum" will be found in Barracks's MS. Journal of 1798, annotated and explained by R. H. Cambage in *Proc. Roy. Aust. Hist. Soc.*, vi, 33. The explorer was then somewhere near Bundanoon. The first use of the term "White Gum" I can trace in print is in *Trans. Linn. Soc.*, xv, 192, 278, 285 (1827), as the abode of certain birds. I invite the attention of correspondents to these early vernacular names. The timber of "Gum," &c., was spoken of by James Flemming, "Journal of Explorations, Port Phillip," p. 25 (1802). It was apparently a common thing to speak of gum-timber by that time.

Early uses of the term "Blue Gum" are as follow:—

"Blue Gum," Collins' "Account of New South Wales," ii, 235 (1802). "Blue Gum Trees," Oxley's "Expedition" (1820).

Whether the first Blue Gum tree was named because the leaves were of a bluish cast (glaucous), or the young stems or branches, or both, cannot be stated with reference to a particular species. It may, or may not be, that *E. saligna*, the "Sydney Blue Gum," was the first species to be called "Blue Gum." Although *E. globulus*, the Tasmanian and Victorian Blue Gum, has a bluer cast, the name, as applied to it, did not get into literature till later than 1802.

The name "Stringybark," which even more than Ironbark is in common use throughout eastern and South Australia, does not appear to have early got into books. We have it in P. Cunningham, *op. cit.*, i, 187 (1827). But Mr. R. H. Cambage, *op. cit.* pp. 9 and 33, shows that it occurs in Barracks's MS. Journal in the Year 1798 in the Mittagong and Moss Vale (New South Wales) districts. In page 33 it is a "short *Stringy Bark*," and therefore perhaps a Peppermint that is spoken of. Later on, one finds it noted as "The String Bark tree" in J. O. Balfour's "Sketch of New South Wales," 37 (1845), and "Vessels formed of Stringybark" are referred to in Westgarth's "Australia Felix," p. 73 (1848).

Then, in noting the earliest reference to Ironbark I can put my hands on, it is to be noted that Gum-tree was synonymous with *Eucalyptus*, and that Ironbark was deemed (correctly) to be a form of Gum. Here we have an undoubted case of the use of the bark as a term in classification—" A species of Gum-tree, the bark of which on the trunk is that of the Ironbark of Port Jackson." See G. Barrington's, " History of New South Wales," p. 263 (1802). Then Allan Cunningham in 1817 uses it in connection with *E. sideroxylon*. See Part XII, p. 82 of the present work. " Ironbark " is mentioned in *Trans. Linn. Soc.*, xv, 260 (1827).

Although there is a reference in the very earliest days of settlement to the Port Jackson timbers reminding the early settlers of Box (*Buxus*) because of their hardness, I cannot trace a very early record of the definite use of the term " Box " as so applied. In any case, the use of the term did not apply to the bark. Allan Cunningham, in his MSS. dated 1817, speaks of " Bastard Box," and this is repeated in Oxley, p. 126 (1820).

Nor was the use of the term " Apple " one borrowed from the bark; it referred to the general appearance of the tree, and, while probably first applied to *Angophora intermedia* was certainly applied to certain straggly, more or less bushy Eucalypts. In Oxley's work, 1820, p. 276, he speaks of " That species of Eucalyptus vulgarly called the Apple-tree." In Leichhardt's " Overland Expedition, etc.," p. 264 (1847), and in other pages, he speaks of " Apple Gum."

I do not know what is the earliest use of the term " Bloodwood," but I find the term " Blood-tree " (for the same thing, but now obsolete) in *Trans. Linn. Soc.*, xv, 271 (1827), where such trees are given the aboriginal name of Mun-ning (probably *E. corymbosa* is meant), and they are stated to be the home of the Banksian Cockatoo. Here again the name does not refer to the bark.

An early reference to the " Cider Gum " (*E. Gunnii*) I find in Ross's " Hobart Town Almanack," 1830, p. 119.

Then we come to " Blackbutted Gum," Peter Cunningham's " Two Years in Australia," i, 187 (1827), in Sturt's " Southern Australia," ii, 236 (1833), and to " Blackbutt," Leichhardt's " Overland Expedition," p. 49 (1847). It was first applied to trees with dark, fibrous barks, which well covered the butts, but when applied to interior situations (the first use is by Sturt), and in the Goldfields of Western Australia, it means a Gum, with more or less flaky, hard, deciduous, bark, reaching not very far up the butt.

The term " Mountain Gum " was first used, so far as I know, by C. Sturt in " Southern Australia," iii, 118 (1833). It is one of those local names, very widely used, which have caused a great deal of confusion.

Then in Leichhardt's " Overland Expedition to Port Essington " (1847) we have (so far as I know) the earliest references to—

1. " Moreton Bay Ash " (*E. tessellaris*).
2. " Flooded Gum," p. 7. This is *E. grandis* (and to a less degree *E. saligna*), and is a reference to the moist situations such trees prefer.

3. " Spotted Gum," p. 11 (following Hooker, 1844). This is *E. maculata*, and is in reference to the spotted or rather blotched appearance of the bark. As knowledge progressed, it was found that a vernacular such as this, and indeed many others, became applied to more than one species. It was used by P. Cunningham, *op. cit.*, 1827. In the same work, at i, 187, I find the term " Woolly Gum," but this is now out of use, being superseded by Woolly-butt.

The earliest reference I can find to the use of the term " Mallee " is by W. Westgarth in " Australia Felix," p. 73 (1848). It is of aboriginal origin.

" Weeping Gum." " A kind of Eucalyptus (this is *E. coriacea*, A. Cunn.—J.H.M.) with long drooping leaves, called the ' Weeping Gum,' is the most elegant of the family." Mrs. Meredith's, " My Home in Tasmania," i, 169 (1852).

The name " Swamp Gum," which I first find in Mitchell's paper in *Proc. Roy. Soc., Van Diemen's Land*, ii, 132 (1853), has much the same meaning as " Flooded Gum."

The use of the name " Lemon Scented Gum " (*E. maculata*, var. *citriodora*) will be found in G. Bennett's " Gatherings of a Naturalist," p. 265 (1860).

We have now arrived at modern times, and can take up the vernaculars in Mueller's writings in the fifties. The indexes of the volumes of the present work catalogue a very large number of vernacular names.

I offer these records of early vernacular names not as exhaustive (they are, indeed, almost casual); they may be useful in inviting the attention of students to trace the dates of entry of some plant-vernaculars into our language.

I will now invite attention to two statements of a general character concerning the barks of the Eucalypts.

As regards Mr. R. T. Baker's statement, as cited below, that the classification by the cortical system was introduced by the first settlers, the observation is not historically correct, although it has a stratum of truth in it. I have just submitted eighteen vernaculars, giving the earliest dates of their use as known to me, but only five of them, it appears to me, viz., Ironbark, White Gum, Blackbutt, Stringybark, Woolly Gum (Woolly-butt), and Spotted Gum, are based on the barks. At the same time the use of the bark for classification by the public is a valuable one, and as people become better informed, they will make a more accurate use of it.

1. " The Gum trees are so designated as a body from producing a gummy, resinous matter, while the peculiarities of the bark usually fix the particular names of the species—thus the Blue, Spotted, Blackbutted, and Woolly Gums are so nominated from the corresponding appearance of their respective barks; the Red and White Gums from their wood; and the Flooded Gum from growing on flooded land." (P. Cunningham's " Two Years in New South Wales," i, 200 (1827).

2. " The first practical classification of our Eucalypts was cortical—one that was introduced by the first settlers of Port Jackson, 1788, and founded on the appearance of the bark, and this grouping of these trees has lasted to this day." (R. T. Baker's " Hardwoods of Australia," p. 137).

2. EUCALYPTUS BARK CLASSIFICATIONS.

i. *Mueller*, 1859.—The first serious attempt (other than that of the unpublished one of Caley) to group Eucalypts by their bark was not made until 1859, when Mueller (*Journ. Linn. Soc.*, iii, 99), as already indicated by me in Part I of the present work, p. 2, divided them into six groups, viz. :—

1. *Leiophloiæ.*—Smooth barks or Gums.
2. *Hemiphloiæ.*—Half-barks or Boxes.
3. *Rhytiphloiæ.*—With wrinkled persistent bark, the least satisfactory of the groups.
4. *Pachyphloiæ.*—Stringybarks.
5. *Schizophloiæ.*—Ironbarks.
6. *Lepidophloiæ.*—Barks friable and lamellar.

I did not quite understand what was meant by No. 6 at Part I, but at Part XXII, p. 37, of the present work, I have fully explained, I think, what Mueller intended to convey.

It was probably the perusal of Mueller's paper that caused Hooker to write to Bentham, under date 8th August, 1859, as follows :—

> Take Eucalyptus altogether as a genus, and it is really a remarkable vegetable, considering the number of forms its bark assumes; that alone would make it notable. (L. Huxley's "Life of Hooker.")

Bentham, 1866.—Then Bentham (B. Fl., iii, 186, 1866) writes—

> F. Mueller has proposed sections founded on the nature of the bark, of the value of which I am totally unable to judge, nor have I any means of availing myself of them, for the specimens themselves never show the character, and a large proportion of them are either unaccompanied by any notes of it, or the collectors' notes are from various causes indefinite, unreliable, or even contradictory.

Then in "Eucalyptographia," Mueller elaborated his system of 1859, as we shall presently see, but he proposes to change his No. 4 (*Pachyphloiæ*) as follows :—

In "Eucalyptographia" (under *E. tetradonta*) he says :—

> . . . the systematic term *Pachyphloiæ*, adopted collectively for all the Stringybark trees, might perhaps give way to the still more expressive designation *Inophloiæ*, all stringybark trees, as the name implies, producing a very fibrous bark.

I am not aware that anyone has followed Mueller in this substitution of *Inophloiæ* for *Pachyphloiæ*. The stringybarks form one of the most natural of the bark-groups, and there is no justification in replacing one established term by another which is a synonym.

Huxley's views on the coining of new technical terms may be quoted here, and the moral is capable of very wide application :—

> . . . . terms which are open to criticism, but which I adopt in the accompanying table, because they have been used. It is better for science to accept a faulty name which has the merit of existence, than to burthen it with a faultless newly invented one. ("Critiques and Addresses," p. 153.)

ii. *Mueller*, 1884.—Mueller, at the end of the "Eucalyptographia" (1884), placed the species under sections, so far as he was able. Following are his lists, and, with our wider knowledge, the positions assigned to many of the species in the sections have since been altered, as will be shown in my grouping of the barks. Mueller's 1884 classification is not an improvement on his 1859 one; the reverse is the case.

1. Leiophloiæ (Mueller, 1884).

pauciflora (*coriacea*).
sepulcralis.
Behriana.
doratoxyton.
diversicolor.
clavigera.
maculata.
cordata.
rostrata.
Gunnii.
salubris.
punctata.
megacarpa.
hæmastoma.
ochrophloia.
platyphylla.
salmonophloia.
latifolia.
corynocalyx (*cladocalyx*).
Torelliana.
urnigera.
tereticornis.
redunca.
saligna.
obcordata.
globulus.

2. Rhytiphloiæ.

stellulata.
polyanthema.
largiflorens (*bicolor*).
populifolia.
drepanophylla.
Raveretiana.
decipiens.
Abergiana.
corymbosa.
eximia.
setosa.
fœcunda.
botryoides.
cornuta.
melliodora.
odorata.
hemiphloia.
pruinosa.
Howittiana.
microtheca.
patens.
terminalis.
trachyphloia.
Watsoniana.
rudis.
resinifera.
robusta.
longifolia.
gomphocephala.

3. Inophloiæ. (An attempted suppression of Pachyphloiæ, as already indicated.)

eugenioides.
acmenoides.
capitellata.
microcorys.
Baileyana.
pulverulenta (*cinerea* is meant, see Part XXI, p. 3).
Stuartiana.
piperita.
obliqua.
macrorrhyncha.
marginata.
Planchoniana.
tetrodonta.

4. Pachyphloiæ.

ptychocarpa. (No. 3 is the same as 4, as we have already seen.)

5. Schizophloiæ.

Sieberiana.
crebra.
siderophloia.
melanophloia.
Cloeziana.
ficifolia.
calophylla.

6. Lepidophloiæ.

phœnicea.
miniata.
peltata.

In the following cases Mueller felt uncertain as to the place in his sections certain species should occupy, and he therefore arranged them as intermediates:—

7. Rhytiphloiæ–Leiophloiæ.

tessellaris.
goniocalyx.
occidentalis.

[We have three very dissimilar barks here.]

8. Schizophloiæ–Leiophloiæ.

paniculata
leucoxylon.

[The reason why Mueller suspended these two species between the Ironbarks and the Smooth-barks, was because he had confused—

(*a*) *E. paniculata* (an Ironbark) with *E. fasciculosa* (a Smooth-bark). The confusion is explained at Part XIV, p. 140.

(*b*) *E. leucoxylon* (a Smooth-bark) with *E. sideroxylon* (an Ironbark). The confusion is explained at Part XII, p. 82.

In other words, *E. paniculata* and *E. sideroxylon* should go to the *Schizophloiæ*, and *E. fasciculosa* and *E. leucoxylon* to the *Leiophloiæ*.]

9. Schizophloiæ–Rhytophloiæ.

drepanophylla.

Here we have a key to the confusion of *E. drepanophylla* (*Schizophloiæ*) with *E. leptophleba* (*Rhytiphloiæ*), see Part XLIX, p. 264.

10. Inophloiæ–Leiphloiæ.

amygdalina.

[Whether he included *E. radiata* in *E. amygdalina* (which is probable), or not, only *Hemiphloiæ* (see p. 322), and *Leiophloiæ* are possibly in question.]

11. Leiophloiæ–Rhytophloiæ.

viminalis.

[*E. viminalis* is normally a Smooth-bark, though never quite free from rough bark at the butt. In some trees this rough bark extends a considerable distance along the trunk. See Part XXVIII, p. 168.]

12. Rhytiphloiæ–Inophloiæ.

pilularis.

[In my view, this is a member of the *Hemiphloiæ*. While there is some variation in the bark, as indeed in so many others, I do not know of sufficient in this species to admit it into the other groups mentioned.]

13. Of the following species, Mueller did not know the nature of the bark, or of that of some of them; being such small species, he felt uncertain :—

stricta.
Oldfieldii.
Todtiana.
buprestium.
uncinata.
gamophylla.
incrassata.
cneorifolia.
vernicosa.
erythronema.
alpina.
pachyphylla.
macrocarpa.
odontocarpa.
tetragona.
angustissima.
santalifolia.
caesia.
gracilis.
alba.
brachyandra.
oleosa.
Foelschiana.
pachypoda.
cosmophylla.
Preissiana.
pyriformis.
tetraptera.
eudesmioides.
erythrocorys.

[Of many of them we can speak now as to their bark, and I have transferred most to a practically natural group, dependent on habit—the Mallees or Marlocks, to be dealt with below, p. 321.]

ii. *Maiden*, 1891.—In the "Educational Gazette of New South Wales" for June, 1891, p. 4, in an article on "The Study of Eucalypts," I wrote as follows (only New South Wales species were dealt with) :—

Because of the height of these trees, and their uncertain periods of flowering, our readiest method of approximately distinguishing between them is by means of their barks. For this purpose we notic two things :

1. The texture, whether smooth, like a "White-gum" (*haemastoma*); spotted like the "Spotted-gum" (*maculata*); scaly, like the "Bloodwood" (*corymbosa*); compactly matted, or sub-fibrous, like the "Woolly Butt" (*longifolia*); or presenting the textures of bark well known under the names of "Ironbark," "Stringybark," and so on.

2. Whether the roughish outside bark extends to the branches (*e.g.*, *corymbosa*), or is confined to the trunk, *e.g.*, Blackbutt (*pilularis*). . . .

Of the several groups of Eucalypts, two are fairly well defined—those with furrowed, hard bark, called Ironbarks, and those with fibrous barks, well known as Stringybarks. Even these two groups are not separated absolutely from the other species, some of which tend to approach them in the texture of their bark; thus, the "Mountain Ash" of the Blue Mountains and the southern mountainous districts (*E. Sieberiana*) (*E. gigantea* was added later.—J.H.M.), sometimes resembles an Ironbark and, in fact, often goes by that name. Also the Peppermint (*E. piperita*), and the Blackbutt (*E. pilularis*) sometimes have barks fibrous enough to fall within the category of Stringybarks. These instances may be largely multiplied, and I go into this detail to emphasise the fact that the local names of Eucalypts are somewhat elastic, and do not usually denote one species and no other. It is therefore desirable, as a rule, to guard against *fitting* botanical names on to the local ones, for we have five Blue Gums for example while some species, *e.g.*, *amygdalina* (*radiata*) have numerous local names.

There are, however, a few Eucalypts which have, I believe, appropriated certain local names to themselves, that is, the following are not ambiguous, and if the local names are properly applied, there is little difficulty in assigning the botanical ones The principal are:—

Bloodwood (*E. corymbosa*), Mountain Bloodwood (*E. eximia*), Blackbutt (*E. pilularis*), Yellow Box (*E. melliodora*), Woolly Butt (*E. longifolia*), Spotted Gum (*E. maculata*), White Mahogany (*E. acmenioides*), Swamp Mahogany (*E. robusta*), Bastard Mahogany (*E. botryoides*), Tallow Wood (*E. microcorys*).

It will be convenient for us to study Eucalypts according to a practical, though not strictly scientific, classification.

1. *Gum Trees*, a term frequently applied in a general sense to all Eucalypts, because there exudes from their trunks a reddish astringent "gum" or kino. The term, in a restricted sense, is applied to those with *smooth barks*. Following are our chief "Gum Trees":—

(*a*) *White Gum* so called on account of the colour of the bark); *hæmastoma, Gunnii, goniocalyx, pauciflora* (*coriacea*), *viminalis*.

(*b*) *Red Gum* (so called on account of the colour of the wood); *E. rostrata* (mainly found on the Murray).

(*c*) *Blue Gum* (these and the following Gums so called on account of the the tint of the bark); *E. saligna*, the principal Blue Gum of the coast districts; *E. Maideni*, south-east New South Wales, for many years deemed to be *E. globulus* (Tasmanian and Victorian Blue Gum).

(*d*) *Grey Gum, E. punctata* (which is sometimes also known as " Leather-jacket ") *E. tereticornis* (which is sometimes also known as " Bastard Box ").

2. Our *Ironbarks* are as follows :—

She Ironbarks (*E. paniculata*), Red-flowering Ironbark (*E. sideroxylon*), Broad-leaved Ironbark (*E. siderophloia*), Narrow-leaved Ironbark (*E. crebra*), Silver-leaved Ironbark of the north west (*E. melanophloia*).

3. Following are our Stringybarks :—

E. obliqua, E. macrorrhyncha, E. capitellata, " Coast Stringybark; also known as " Broad-leaved or Silvery Stringybark," owing to its greyish bark. *E. eugenioides* " Stringybark " (has a warm brown cast). Coast and Blue Mountains.

4. *Box.* When a Gum-tree has a closely-matted fibrous bark, with interlocked tough wood, it is usually termed a " Box," from a fancied resemblance to the Turkey box-wood which is used for engraving. Following are our principal New South Wales Box-trees :—

E. hemiphloia, the commonest Box of the coast districts; *E. largiflorens* (*bicolor*), Grey Box; *E. microtheca,* Bastard Box, or Coolibah of the interior; *E. polyanthemos,* under this botanical name there is no doubt that two distinct trees, viz., Red Box or Slaty Gum, and *lignum vitæ* or Poplar-leaved Box, are included. (The latter is *E. Baueriana,* as afterwards ascertained); *E. populifolia* Bimble Box.

5. *Mahogany.* Some of our Eucalyptus timbers are called " Mahoganies," owing to a resemblance in appearance and texture to West Indian Mahogany. They are as follows :—

White Mahogany (*E. acmenioides*), Bastard Mahogany (*E. botryoides*), Swamp Mahogany (*E. robusta*), Red or Forest Mahogany (*E. resinifera*).

iv. *Cambage,* 1913. Mr. R. H. Cambage, *Journ. Roy. Soc., N.S.W.,* xlvii, 30, 1913, classifies Eucalyptus barks into five groups :—

1. *Smooth.* The *Leiophloiæ* of Mueller; the Gums.
2. *Scaly.* He gives *E. corymbosa,* of the Bloodwood group, . . . as a type.
3. *Scaly to sub-fibrous.* This is an intermediate group, and includes the Boxes.
4. *Fibrous.* The *Pachyphloiæ* of Mueller; the Stringybarks.
5. *Furrowed.* The *Schizophloiæ* of Mueller; the Ironbarks.

I reproduce what he said, for he makes the first geographical classification of some of the barks.

For the purpose of discussing the distribution of various kinds of bark, only well marked types have been selected, between each of which there are insensible gradations. I have not included the *hemiphloiæ* or half-barked section, because this designation gives no clue whatever to the nature or texture of the bark on the lower portions of the boles, and this character of rough bark occurring on the trunk in varying extent, with smooth branches, may be found distributed in some measure throughout most of the sections.

"There are so many gradations in the textures of the Eucalyptus barks, that it is impossible to account for them all in detail within the limits of five sections, and in a few cases a particular class of bark may be almost equally distributed over two climatic divisions.

"In considering the allocation of the sections in New South Wales, the following four geographical divisions will be referred to, viz. :—the Coastal Area, the Mountain Region, Western Slopes, and Interior (see Plate I, not reproduced). In the following table the word "first" signifies "most abundant," and "fourth" denotes "least abundant" in the particular division under which the number appears.

Barks.	Coastal.	Mountains.	Western Slopes.	Interior.
Smooth	Second	First	Third	Fourth.
Scaly	First	Fourth (?) ...	Second	Third (?).
Scaly to sub-fibrous	Third	Fourth	Second	First.
Fibrous	First	Second	Third	Fourth.
Furrowed	First	Fourth	Second	Third.

"*Smooth Barks.*—The smooth barks, which include such trees as *Eucalyptus viminalis* and *E. coriacea*, are perhaps more typical of the Mountain Region than any other, with the Coastal Area ranking a close second. It seems remarkable that as the ascent is made, especially above 4,000 feet, and the more rigid climatic conditions are encountered, the Eucalypts, particularly if growing in the open, instead of being more densely coated with thick fibrous bark, are gradually restricted to the smooth-barked types, such as *E. coriacea* and *rubida* in New South Wales and Victoria, and *E. Gunnii*, *coccifera*, and *vernicosa* in Tasmania. This goes to show that the actual protective qualities of the bark are not wholly regulated by the texture, but also depend upon the constituents contained in the bark.

"*Scaly Barks.*—Among the scaly-barked Eucalypts, of which *E. corymbosa* of the Bloodwood group may be considered as a type, there are various gradations, and the section may be extended to include such trees as *E. robusta*. This class of bark, which is something between a scaly and a woolly, probably most nearly represents that of the earliest type of Eucalypt, and is most plentiful in the Coastal Area, next on the Western Slopes, and least in the Mountain Region.

"*Scaly to Sub-fibrous.*—In the sub-fibrous class, or what is a sort of transition from scaly to shortly-fibrous, we have amongst others *E. populifolia* and *E. hemiphloia*, of what are known as the Box-tree group, the bark of which is usually of a grey colour. The fibre is very short, the bark not particularly thick and usually covers most of the trunk and often the branches as well. The Box timbers are very hard, and like the Ironbarks, this class of Eucalypt absolutely shuns the colder situations, neither group having a representative in Tasmania. The Box-tree section is most common in the Interior and next to that, on the Western Slopes, occurring also in the Coastal Area, but absent from the mountains above an altitude of 3,000 feet in latitudes south of 32 degrees.

"*Fibrous Barks.*—The commonest forms of fibrous-barked trees are known as Stringybarks, of which *E. eugenioides* and *E. obliqua* may be mentioned as types. Most of these Stringybarks occur in the Coastal Area, and next in the Mountain Region, while there is only one species, *E. macrorrhyncha*, on the Western Slopes, and, except for an occasional tree of the last-mentioned species, the fibrous-barked Eucalypt is unknown in the Interior. This distribution is of great interest, and appears to be in response to climatic conditions. A second form of fibrous bark, which is less stringy than the typical Stringybarks, and usually of a grey colour, is known as Peppermint-bark, from the fact that the species on which it grows possesses leaves which emit a strong odour of peppermint when crushed. The Peppermint group, of which *E. dives*, *Andrewsi*, *amygdalina* (*radiata*), and *piperita* are typical, belongs chiefly to the Mountain Region, and occurs also in the Coastal Area, but is absent from both the Western Slopes and the Interior, in fact, to an observer descending the western side of the mountains, the presence of the Peppermints is evidence that cool conditions have not yet been left behind, while the occurrence of the Box-trees denotes that the country below the margin of the winter snow has been reached, and that fairly warm and comparatively dry conditions prevail. Three of the typical Peppermints, viz., *E. dives*, *amygdalina* and *Andrewsi*, rarely, if ever, descend below an altitude of 2,000 feet in latitudes north of 35 degrees, so that it seems probable that prior to the great uplift in the Kosciusko period, these species, in their present state of development did not exist in New South Wales except perhaps in the extreme south, and this latter possibility could apparently only apply to the first two.

"*Furrowed Barks.*—The hard furrowed-barked trees of which the Ironbarks *E. crebra* and *E. sideroxylon* may be regarded as types, are most numerous in the Coastal Area, and next to that, on the Western Slopes, being practically unknown in the Mountain Region above an altitude of 3,000 feet. It seems curious that the one condition these hard-timbered, thick-barked Eucalypts avoid more than any other, is the cold. One species with equally rough furrowed bark on the trunk, but with softer fissile timber, viz., *E. Sieberiana*, which belongs to the Mountain Ash group flourishes from the sea level up to an elevation of about 3,500 feet on the ocean side of the mountains, but is almost unknown west of the Main Divide. *E. Smithii* is another species with furrowed bark on the lower part of the bole, and is found east of the Main Divide below an altitude of 3,000 feet."

v. *Baker*, 1919.—Mr. R. T. Baker in his "Hardwoods of Australia," p. 137 (1919) divides Eucalypts into eleven groups, according to the barks, as follows :—

"1. Bloodwoods.—In this group of trees the bark is rough, rigid, reddish in colour, friable, and very short in the fibre, with medium furrows.

"2. Mahoganies.—These have a bark almost identical with that of the Stringybarks.

"3. Boxes.—This is a more compact, fibrous-ridged bark than any of the previous groups, a light grey in colour, and the lattice pattern much smaller than in the Stringybarks, the furrows less deep than in any other lattice pattern group.

"4. Tallow Woods.—This bark is yellow ochre in colour, laminated and scarcely rigid or furrowed.

"5. Stringybarks.—These are characterised by the long fibres which intertwine and cross lattice-like, forming ridges and depressions, and are reddish-brown or grey in colour.

"6. Woollybutts.—This bark may be described as a coarser kind than, or variety of, the Box bark.

"7. Blackbutts.—These have similar characters to the Stringybarks, only black at the surface, as though burnt, and not extending so far up the trunk or branches.

"8. Gums.—The largest group of all, having a smooth, pinkish, yellowish tint or whitish bark.

"9. Peppermints.—These barks might be described as a fine lattice pattern, and rather closer in texture than that of the Stringybarks, but shorter in the fibre and the colour more bordering on that of the Boxes.

"10. Ashes.—Somewhat similar in character to the Blackbutts.

"11. Ironbarks.—A hard, rugged, compact, broadly-latticed pattern, high ridged bark, either black or grey on the outer surface, and always dark red inside."

Some of these barks are illustrated, usually in profile.

vi. *Maiden*, 1921.—

Following is a grouping of the barks so far as I have been able to do it, and I would point out that no approximately complete classification can be offered until our knowledge of some barks is very much more complete than it is at present.

It will be found desirable, in the present state of our knowledge, to combine study of the bark with that of size and habit of the species. In due course I shall offer a large number of photographs which illustrate these three characters. Further, it seems natural and convenient to combine colour (and even texture) of timber with the above classification, based on external characters, as it is the common practice of the Australian botanist and forester to use the tomahawk or axe in making his examination in the forest.

As I base my classification on that of Mueller's of 1859, it may be a convenience at the outset to eliminate the smaller species (Mallees or Marlocks), partly because they form a natural group, and partly because they are not classified according to their barks. Nor are their timbers classified in practice as it is. They may, for the most part, be looked upon as depauperate Gums. I will make a few preliminary remarks on size, and, by the elimination spoken of, we shall be in a position to more conveniently study the remaining species.

Descriptions of Barks necessarily tentative.—In describing the general appearance of the trees and their barks, I have, as frequently as possible, stood in front of what I considered average trees, and have written the descriptions on the spot. But these descriptions have been done at different times. Further, some of the descriptions have been written by different hands, some of them have been written at considerable intervals of time, while some are short and some are long. As a result, the terms employed for the same object vary with the talent and the experience of the authors as descriptive writers. It becomes, therefore, a matter of careful research to standardise these descriptions, and I can do no more than hope that the beginning I have made may be found useful.

Following is my proposed classification :—

O. Mallees (or Marlocks).

(To be eliminated from the general bark, &c., classification, as a matter of convenience. I list them below as True Mallees, False Mallees, and Marlocks.)

1. *Leiophloiæ* (Smooth-barks or Gums).

I propose the following provisional sections :—

A. Shaft-like or columnar.

(*a*) Pale timbers.

(*b*) Red timbers.

B. More or less erect in habit, but not shaft-like.

(*a*) Pale timbers.

(*b*) Red timbers.

(*c*) Brown timbers.

C. Scrambling in habit.

(*a*) Pale timbers.

(*b*) Dark-coloured timbers, red to reddish-brown.

D. Western Australian Blackbutts.

E. Gimlet Gums.

F. Grey and Spotted Gums.

2. *Hemiphloiæ* (Half-barks).

(*a*) Renantheræ, with pale timbers. Including eastern Peppermints, also Blackbutts and Mountain Ash.

(*b*) Boxes (timbers pale).

(*c*) Timbers reddish-brown.

(*d*) Western Australian species (a provisional group).

3. *Rhytiphloiæ* (Whole-barks, in contradistinction to the Hemiphloiæ).

(*a*) Pale timbers.

(*b*) Red timbers (Mahoganies in part).

4. *Pachyphloiæ* (Stringybarks), including a small group of dwarf species.

5. *Schizophloiæ* (Ironbarks), also (*a*) Ironbark-Boxes, an intermediate group.

6. *Lepidophloiæ* (with lamellar or uniformly flaky barks—the Bloodwoods).

(*a*) Dark-barked and with red timber.

(*b*) Yellow-jackets, with pale timber.

(*c*) An intermediate small group (including *E. calophylla*), with pale timber.

(*d*) Eudesmiæ (excluding the Marlocks).

(*e*) Tessellatæ (those with tesseræ on the lower part of the trunk, *e.g.*, *E. tessellaris*.

(*f*) Angophoroideæ (species, *e.g.*, *E. clavigera*, very closely allied to *Angophora*).

O. Mallees, Marlocks, and other small species.

The vast majority of Eucalypts will be found to be under 150 feet in height, while in the interior districts a tree of 100 feet is accounted a large one. Some of the largest trees have been referred to at Part XLVIII, p. 254.

The smallest species are mostly included under the Mallees (Marlocks). While it is obviously simple to record those which are, in the present state of our knowledge, largest and smallest, the puzzle is to classify the intermediate forms. This is the difficulty that so frequently confronts us in Eucalyptus—we have ascertained A and Z (or think we have), but what are we to do with B to Y. Even in Mallees and Marlocks we have this problem of intermediates.

A large number of species may be described as small—Mallees and Marlocks—the smaller ones usually spindly and with the bark smooth, but exhibiting the usual exfoliation which result in the falling-off of ribbons, or of flakes of old, hard bark. The majority of them naturally occur in " hard " conditions, and are assumed to be old or disappearing forms, struggling in a difficult environment.

We must bear in mind that we know so little about some species that we cannot say whether we shall later find that they attain a very much larger size. Dwarf species only exceptionally attain the dignity of a tree from which timber may be cut. In a few cases (*e.g.*, *E. redunca*) the typical form is a shrub, while a variety assumes tree-form.

Mueller touched on the difficulty in the following passage: " The characters of shrubby Eucalypts proving generally less constant than those of the tall timber-trees of this genus." (" Eucalyptographia," under *E. occidentalis*).

Some Mallees, when they attain their best development, grow into medium-sized trees, 30–40 feet being common, and a height of 50 feet not being rare, while the very exceptional height of 70 feet (measured) in the case of *E. gracilis* is worthy of special note, and, perhaps later, of special classification. In other words, we must bear in mind that the usual idea of a Mallee being a shrub may require a good deal of modification.

When the plant consists of a number of small stems close together it goes by the name of " Whipstick Mallee."

Some general notes on Mallee will be found in Part IV, pp. 94, 98, of the present work. For a valuable paper on the development of Mallees, *see* Fletcher and Musson in *Proc. Linn. Soc. N.S.W.*, xliii, 199 (1918), which is abstracted in the present work, Part XLIX, p. 284.

There is a certain amount of convenience in a geographical classification of Mallees, thus we have :—

a. True Mallees.

True Mallees (as originally defined), with large bulbous root-stocks. Found in regions of comparatively low rainfall, and in plain country.

Speaking generally, it may be said that Mallees are smooth-barked, thin-barked, and bark-bound when young, and later, the outer bark falls off more or less abundantly as ribbons. As development proceeds the rough bark on the lower part of the trunk becomes less ribbony, and more or less flaky and hard, till at length—at maturity, and when there is no necessity for the fall of the bark—the butt becomes rough-barked, with a dark-coloured, hard-flaky, sub-fibrous exterior.

I shall show, under Gums, that the state of having a smooth bark is an ideal, and it will be later proved that all groups of barks have exceptions more or less important. Mallees do not escape this general law. For example, *E. Camfieldi* and *E. ligustrina*, which might by some be classed with the Mallees, seem better placed under the Stringybarks.

One must bear in mind that the typical Mallee, with its bulbous root-stock and many comparatively thin stems, often arranged in a more or less circular manner, is a condition arrived at as the result of environment, but the same species may be single-stemmed and like an ordinary tree in appearance. This dimorphous character has given difficulty to many people, who have thought that the two forms represented different species.

Following is a provisional list :—

E. Bakeri Maiden.

E. Behriana F.v.M.

E. calycogona Turcz.

E. cneorifolia DC.

E. dumosa A. Cunn.

E. fruticetorum F.v.M.

E. Gillii Maiden.

E. gracilis F.v.M.

E. incrassata Labill.

E. leptophylla F.v.M. (to be dealt with in a subsequent Part).

E. Morrisii R. T. Baker.

E. oleosa F.v.M.

E. uncinata Turcz.

E. Thozetiana F.v.M. (For a note on this tree, see Section B. of Gums).

E. viridis R. T. Baker (*acacioides* A. Cunn.).

E. Bakeri Maiden.

A large shrub, or small pendulous, willow-like tree, attaining a height of 30–50 feet, forming a single stem, or stooling from the ground. Bark dark, box-like, or hard and scaly on trunk, branches smooth. Timber hard and heavy, deep red when freshly cut, drying browner.

E. Behriana F.v.M.

A tall shrub or small tree up to 20–30 feet and more, with one or two dozen stems of 3 to 4 inches in diameter springing from one root. The bark always smooth and commonly of a dark, oily-looking green.

E. calycogona Turcz.

Up to 25 or 30 feet, with a smooth bark. At Wedderburn (Victoria), 25–30 feet, usually with only one stem, and a smooth greyish bark very similar in colour to *E. fruticetorum* (F. W. Wakefield). Speaking of Pinnaroo, Mr. J. M. Black describes this Mallee as 16 to over 30 feet high and 20–24 inches in diameter in cases where the trees have been cut down. Inner bark smooth and pale grey, outer bark brown, rough and peeling. Near the Ninety-mile Desert it flowers as a Whipstick Mallee under 10 feet high.

E. cneorifolia DC.

A Mallee confined to Kangaroo Island, South Australia, where it is known as "Narrow-leaf." In some places they may be a foot in diameter, but usually the trunks are only as thick as a man's arm, and forming an impenetrable scrub. Where it forms a single stem, it may attain a height of 40 feet with a white stem with a more or less box-scaly roughness (see J.H.M. in *Journ. Roy. Soc. S.A.*, xxxii, 279).

E. DUMOSA A. Cunn.

"White Mallee." The type is a large shrub or small tree of 20–40 feet, the clumps having about 6–8 stems of equal size, and the whole plant more or less glaucous in appearance. The outer bark of a scaly nature and of a dark-brown colour, falling off in irregular-shaped patches, the smooth bark being of a bluish-white or even straw colour, but these colours vary. Because of this paleness the species is often known as "White Mallee."

E. FRUTICETORUM F.v.M.

"Blue Mallee." A glaucous Mallee, with quadrangular branchlets, with willowy, light-coloured stems.

E. GILLII Maiden.

A glaucous Mallee, attaining a height of 20 feet, the stems and branches rather crooked.

E. GRACILIS F.v.M.

"White Mallee." A graceful species of 10–20 feet in a type locality. Sometimes, as with other Mallees, it becomes a medium-sized tree, with only one stem. In its wide range it is often found up to 40 feet in height, and exceptionally (as Kong Mallee see Part XXXIX, p. 265) it may attain the exceptional height of 70 feet (measured). The timber is brown. The above remarks apply to South Australia, Victoria, and New South Wales, but in Western Australia it becomes a Blackbutt; see Part LI.

E. INCRASSATA Labill.

We cannot speak definitely about the bark of the typical species until the identity of the species is cleared up. See Part XXXVIII, p. 223.

Variety *angulosa* Schauer. This is by far the most abundant form of *incrassata* in the south coastal districts of Western and South Australia. In sheltered places near the sea it forms large shrubs or small trees, shapely, with dense foliage forming an agreeable shade, and a graceful ornament to the beach. On the Kalgan Plains, W.A., it is the tallest of the Mallees (say 15 feet), with fleshy, large leaves. In such situations, which are more exposed, it has smooth, clean stems (say 3 inches) with the leafy branches coming less close to the ground.

E. MORRISII R. T. Baker.

"Grey or Black Mallee." The bark dirty grey and slightly roughened. As growth proceeds we have ribbons, more or less, and eventually blackish, half-flaky bark at the butt. The short butts may be up to nearly 2 feet in diameter. I have seen it nearly 40 feet high, though it is usually only about half that size.

E. OLEOSA F.v.M.

"Red Mallee." The type was described (from South Australia) as a shrub of the height of a man, but it may attain the usual size of Mallees, *e.g.*, 30 or 40 feet or more. It has toughish bark at the butt, but the upper portion and the branches are smooth.

E. UNCINATA Turcz.

A slender Mallee, usually not exceeding 10 feet in height, confined to coastal south-western Australia.

E. VIRIDIS R. T. Baker (*acacioides* A. Cunn.).

A tall, spindly shrub or slender small tree, attaining a height of 20–30 feet. Bark smooth, a little hard, scaly bark at butt.

b. **False Mallees.**

False Mallees, or Mallee-like shrubs, with bulbous root-stocks reduced in size or absent. Found in regions of comparatively high rainfall, in rocky coastal districts and tablelands (of New South Wales) sometimes ascending to a considerable elevation.

There is no strict line of demarcation between these and the generally recognised Mallees.

E. apiculata Baker and Smith.
E. approximans Maiden.
E. Baeuerlenii F.v.M.
E. coccifera Hook., f.
E. diversifolia Bonpl.
E. Moorei Maiden and Cambage.
E. Kybeanensis Maiden and Cambage.
E. neglecta Maiden.
E. nitida Hook., f.
E. obtusiflora DC.
E. parvifolia Cambage.
E. pulverulenta Sims.
E. pumila Cambage.
E. stricta Sieb.
E. urnigera Hook., f.
E. vernicosa Hook., f.
E. virgata Sieb.

E. APICULATA Baker and Smith.

A shrub of 6–8 feet, forming a scrubby growth.

E. APPROXIMANS Maiden.

A Mallee-like plant of 4–10 feet high.

E. BAEUERLENI F.v.M.

Few or many stemmed; attaining a height of 40 feet, up to 15 inches in diameter; bark smooth, hide-bound, brownish. Timber pale-coloured, hard.

E. COCCIFERA Hook., f.

Quite a small tree (under 20 feet in height) with a smooth, white bark, but much smaller on the exposed tops of mountains.

E. DIVERSIFOLIA Bonpl.

A Mallee-like shrub or small tree, up to 20 feet high. Has a smooth bark with ribbons.

E. KYBEANENSIS Maiden and Cambage.

A Mallee of 6–10 feet, with smooth, greenish stems $1\frac{1}{2}$ inches in diameter.

E. MOOREI Maiden and Cambage.

An erect, rather slender, shrub of up to 10 or 13 feet in height, with a stem-diameter of 2 to 4 inches. It forms dense masses of small area, reminding one somewhat of a Whipstick Mallee, but lacking the root-stockiness of a Mallee. About 1 mile west of Hartley Vale Railway Station, Mr. W. F. Blakely (in June) found it from 6–20 feet, when highest forming nice straight poles, with a diameter of 5–6 inches. Bark at base dark and rough, changing to smooth, and dark green to glaucous in colour.

E. NEGLECTA Maiden.

A tree of small size, sometimes described as scraggy when old, not exceeding 20 feet in height. Smooth and ribbony. Grows in clumps forming a dense thicket, the stems appearing "to be independent saplings and not suckers from a common crown."

E. NITIDA Hook., f.

Shrubs or small stunted trees, with a little scaly or ribbony bark at butt. "At Currie's River, Tasmania, it formed low bushes, about 5 feet high, but occasionally a few feet higher. It grew in the poor sandy land near the sea." (Gunn.)

At the same time, the type is described (see Part XXXVIII, p. 235) as "a fairly tall tree with hanging branchlets." So far as I understand this species, it is a tall shrub or small tree, but it requires further investigation.

E. OBTUSIFLORA DC.

An erect shrub or small tree, smooth or with a little ribbony bark. It forms bushes, with branches smooth and glaucous, the young bark greenish or bluish, peeling off in ribbons.

E. PARVIFOLIA Cambage.

A small, umbrageous tree, reaching 20–30 feet, rarely 40 feet, with a stem-diameter of up to 18 inches. Bark smooth, dull grey. This species affords one of the difficulties of grouping by Habit.

E. PULVERULENTA Sims.

A scraggy, spindly, tall shrub or small tree, 15 feet high, and up to 3 inches in diameter. Has a long, weak trunk, of pretty uniform diameter, say 2 inches on the average; quite prostrate or quite erect, and also spreading and rambling. It is smooth-barked, with short ribbons (Mount Blaxland is the type). At Apsley, near Bathurst, the size is greater, from 10–30 feet, with a diameter of 3 inches. Wood pale-coloured and tough.

E. PUMILA Cambage.

A tall shrub of many separate stems, reaching 15–20 feet, with a stem diameter of 2–3 inches.

E. STRICTA Sieb.

The Scrubby Gum of the Blue Mountains and other places, a dwarf Gum, forming an almost impenetrable scrub of 6-15 feet, the thin, smooth, bark falling off in strips. I have, however, seen it larger—up to nearly 30 feet—where there is good soil and moisture, *e.g.*, in the taluses of mountains.

E. URNIGERA Hook., f.

A small tree of 15–20 feet, with spreading branches and a smooth bark, usually blotched with red or brown.

E. VERNICOSA Hook., f.

"An erect shrub 4–6, rarely 12–20. Bark smooth." (Rodway).

E. VIRGATA Sieb.

A straggling, tall, shrub or small tree, rarely exceeding a height of 15 to 20 feet or a stem-diameter of 3 inches. More or less glaucous, the stems smooth.

(*c*) Marlocks.

Marlock is the Western Australian equivalent of Mallee, and, like it, is a term somewhat loosely used. It includes all Gum-scrub, *i.e.*, dwarf species or individuals, on a sand-plain. Maalock is an old spelling, and means a thicket more or less dense. It may include the true Mallee of the more eastern States, *i.e.*, a dwarf Eucalypt with a thickened stocky stem more or less embedded in the light sandy soil. There are various qualifying adjectives, such as Black, White. A few species have their own special names, *e.g.*, Moort (for *E. platypus*) in addition to the general one of Marlock, which is mostly in use in the southern part of the State.

E. angustissima F.v.M.
E. annulata Benth.
E. buprestium F.v.M.
E. cæsia Benth.
E. cornuta Labill (a note).
E. decurva F.v.M.
E. diptera Andrews.
E. doratoxylon F.v.M.
E. Ebbanoensis Maiden.
E. eremophila Maiden.
E. erythronema Turcz.
E. erythrocorys F.v.M.
E. eudesmioides F.v.M.
E. Ewartiana Maiden.
E. falcata Turcz.
E. Forrestiana Diels.
E. goniantha Turcz.
E. grossa F.v.M.
E. Jutsoni Maiden.
E. Kruseana F.v.M.
E. Lehmanni Preiss.
E. leptopoda Benth.
E. macrandra F.v.M.
E. macrocarpa Hook.
E. micranthera F.v.M.
E. occidentalis Endl. (a note).
E. odontocarpa F.v.M.
E. Oldfieldii F.v.M.
E. orbifolia F.v.M.
E. pachyloma Benth.
E. pachyphylla F.v.M.
E. Pimpiniana Maiden.
E. platypus Hook.
E. Preissiana Schau.
E. pyriformis Turcz.
E. Sheathiana Maiden.
E. spathulata Hook.
E. Stowardi Maiden.
E. tetragona F.v.M.
E. tetraptera Turcz.
E. Websteriana Maiden.

E. ANGUSTISSIMA F.v.M.

A bushy shrub of 5 feet; a very imperfectly-known species.

E. ANNULATA Benth.

A tall shrub with a smooth bark. Others have described it from 7–12 feet, while Diels and Pritzel have seen it from 6 to 32 feet, with an ash-coloured smooth bark. It is evidently one of those species which, like the eastern Mallees, may develop into a fairly large size.

E. BUPRESTIUM F.v.M.

A tall shrub, sometimes up to 15 or 20 feet, with a Mallee habit; smooth stems.

E. CÆSIA Benth.

A Mallee, about 12 feet high, bark smooth, tough, stripping in long lengths.

E. CORNUTA Labill.

The Yate. Sometimes forms Marlock thickets.

E. DECURVA F.v.M.

A tall, spindly, Mallee-like shrub of 10–15 feet, but may attain a larger size. The upper parts of the branches glaucous, the branchlets red.

E. DIPTERA Andrews.

A slender tree of 10–20 feet.

E. DORATOXYLON F.v.M.

Usually a shrub or small tree, but Mueller quotes an authority that its trunk may appear 3 feet in diameter. I have not been able to obtain confirmation of this.

E. EBBANOENSIS Maiden.

It attains a height of 30 feet, with a diameter of 9 inches; bark smooth.

E. EREMOPHILA Maiden.

A shrub or medium-sized tree, with smooth, scaly bark.

E. ERYTHROCORYS F.v.M.

Stems white, smooth, a small shrub, or attaining a height of 30 feet.

E. EUDESMOIDES F.v.M.

"Shrub 4–12 feet with a smooth bark; called also a White Gum, a smooth-barked, straggling tree of 20 feet. As a rule seen as a bush. Branchlets brown."

Stated to reach "a height of 50–80 feet in Central Australia, the trunk silver-grey in colour and very shiny, except the butt, where it is covered with a paper-like bark which peels off in long, yellow-brown scales." (Prof. Baldwin Spencer.) See Part XLVI, p. 167.

It is a species that deserves further enquiry, as it is apparently one of the dimorphic species—a small Mallee or a big tree, according to environment.

E. ERYTHRONEMA Turcz.

A tall shrub or small tree up to 20–30 feet, a crooked trunk of 10 feet, diameter 1 foot, with very light grey, smooth bark.

Mr. E. A. le Souef, of South Perth, says :—" I asked my collector about its habit. He says that where it is swept by fire it is a Mallee, having a large woody stock root, and several thin stems from it, but where fire never reaches it it grows into the ordinary tree from 12 to 15 feet in height.

E. EWARTIANA Maiden.

Many stemmed, 10–15 or 20 feet high. The stems 3 inches in diameter. The bark is peculiar, falling off in narrow, longitudinal pieces, giving it a striped appearance, rare in Eucalyptus.

E. FALCATA Turcz.

A Mallee of 10–15 feet, with very slender stems. Of somewhat drooping habit.

E. FORRESTIANA Diels.

A shrub of 5–10 feet, never divaricate.

E. GONIANTHA Turcz.

Unknown, but probably a shrub or small tree.

E. GROSSA F.v.M.

A shrub of 3–9 feet, with broadly spreading branches.

E. JUTSONI Maiden.

A small, thin-stemmed, branching-from-the-root Gum, about 6–8 feet high on the average.

E. KRUSEANA F.v.M.

A straggling shrub, about 8 feet high.

E. LEHMANNI Preiss.

A shrub, forming a Marlock growth, or a small tree up to 30 feet high, and up to 12 inches in diameter.

E. LEPTOPODA Benth.

A thin, wiry, rather erect tall shrub or small spindly tree, with several stems together.

E. MACRANDRA F.v.M.

A shrub or small tree with a smooth bark.

E. MACROCARPA Hook.

A stout shrub of 6–10 feet, usually more or less mealy-white.

Up to 14 feet (W. D. Campbell). It forms copses, hard to get through, usually very crooked in its growth. Stems thin, long. The bark smooth and varies from pale to dark grey.

E. MICRANTHERA F.v.M.

A shrub of 6 to 10 feet with a smooth bark.

E. OCCIDENTALIS Endl.

The Yate. Often forms Marlock thickets.

E. ODONTOCARPA F.v.M.

Shrub of 8–10 feet. A Mallee.

E. OLDFIELDII F.v.M.

A stiff shrub of 8 or 10 feet, with many thin stems close together, forming an impenetrable scrub, but not a true Mallee.

E. ORBIFOLIA F.v.M.

A shrub of 5 feet.

E. PACHYLOMA Benth.

A spindly, sand-plain Gum, not known to attain tree size.

E. PACHYPHYLLA F.v.M.

A tall shrub otherwise described as " bush 8–12 feet high " and " dense bushes, 10–15 feet high."

E. PIMPINIANA Maiden.

A shrub of 3–5 feet, but very little is known about it.

E. PLATYPUS Hook.

A tree attaining 30 feet, with a smooth bark. Forms gregarious small trees erect in habit, with smooth bark, a little ribbony at butt. It is specifically referred to as Marlock by Mueller and Morrison, but it varies in size.

E. PREISSIANA Schau.

It forms spindly shrubs up to 10 feet; so far as I saw, most of them smaller. Mueller says it attains a height of 15 feet.

E. PYRIFORMIS Turcz.

A slender shrub, with long weak stems.

E. SHEATHIANA Maiden.

A slender young tree, probably a Marlock.

E. SPATHULATA Hook.

A shrub of 6–8 feet or rather more. In the form known as Swamp Mallet, and which is believed to be specifically identical, it is a tree from 20–30 feet.

E. STOWARDI Maiden.

" A shrubby Mallee."

E. TETRAGONA F.v.M.

" A low scrubby shrub, densely covered with a white meal, to a small tree of 20–25 feet." A " White Marlock."

E. TETRAPTERA Turcz.

A shrub or small tree (rarely above 10 feet), the branches nearly terete or very prominently four-angled, almost winged.

E. WEBSTERIANA Maiden.

A shrub of 6 or 10 feet.

Explanation of Plates (204–207).

PLATE 204.

Eucalyptus Houseana (W. V. Fitzgerald) Maiden.

1*a*. Juvenile leaves; 1*b*, mature leaf; 1*c*, umbel of buds; 1*d*, front and back view of anther; 1*e*, twig shows mature leaves and buds; 1*f*, compound spike of buds, the leaves being apparently deciduous. Isdell River, near Mount Barnett Homestead, Kimberley, North-West Australia. (W. V. Fitzgerald, No. 1,014.) The type.

2. Juvenile leaves. On flats, Pine Creek to Wandi, Northern Territory. (Dr. H. I. Jensen.)

3. Juvenile leaves, Burrundie, Northern Territory. (G. F. Hill, No. 360.)

4. Fruits, Pine Creek, Northern Territory. (G. F. Hill, No. 345). Identical with those of 380, Mt. Diamond to Wandi Flats. (G. F. Hill.)

PLATE 205.

Eucalyptus Jutsoni Maiden.

1*a*. Flowering twig; 1*b*, buds; 1*c*, different views of anthers. Comet Vale, north of Kalgoorlie, Western Australia. (J. T. Jutson, No. 216.) The type.

Eucalyptus adjuncta Maiden.

2*a*. Twig, bearing mature leaf, buds, and flowers; 2*b*, different views of anther; 2*c*, fruit-bearing twig. Wyee, N.S.W. (Andrew Murphy.) The type.

PLATE 206.

Eucalyptus pilularis Sm., var. *pyriformis* Maiden.

1*a*. Juvenile leaf; 1*b*, Intermediate leaf; 1*c*, mature leaf; 1*d*, operculum covering umbel; 1*e*, buds; 1*f*, two views of anther; 1*g*, two views of fruits, usually pyriform when not fully ripe; 1*h*, an old fruit, hemispherical and with a thick rim. Bucca Creek, near Coff's Harbour, N.S.W. (J. L. Boorman.) The type.

Eucalyptus pumila R. H. Cambage.

2*a*. Juvenile leaf in almost the earliest stage; 2*b*, intermediate leaves; 2*c*, mature leaf; 2*d*, buds; 2*e*, front and back views of anther; 2*f*, an umbel of scarcely ripe fruits; 2*g*, umbel of ripe fruits. Pokolbin, N.S.W. (R. H. Cambage, No. 1,506.) The type.

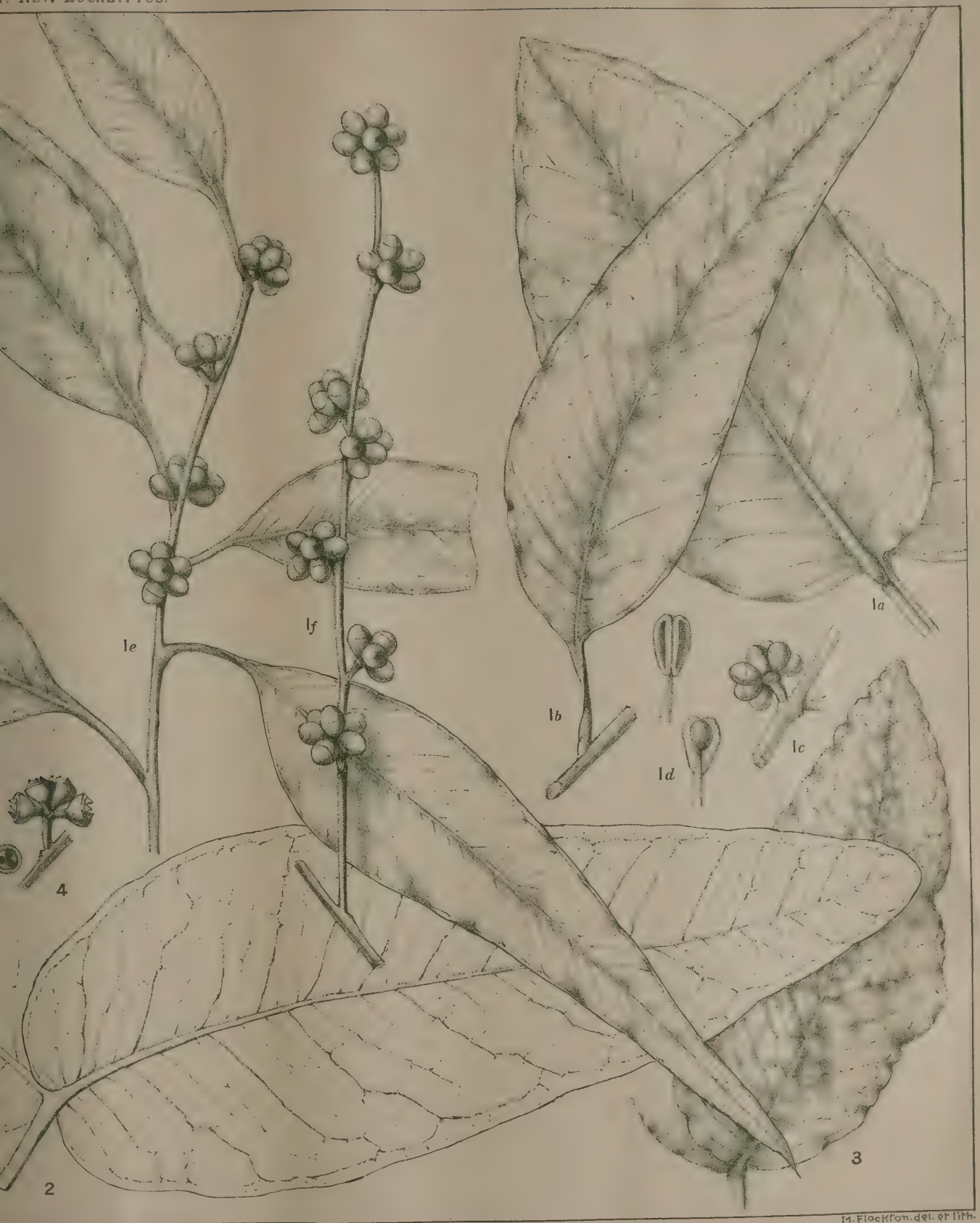
PLATE 207.

Eucalyptus rariflora Bailey.

1. Juvenile leaf, reproduced from Mr. Bailey's drawing; 2*a*, juvenile leaf; 2*b*, 2*c*, intermediate leaves; 2*d*, mature leaf; 2*e*, buds; 2*f*, front and back views of anther; 2*g*, fruits. Eidsvold, Queensland. (Dr. T. L. Bancroft.) Dr. Bancroft supplied the specimens from the same locality to Mr. Bailey for the type.

Eucalyptus Mundijongensis Maiden.

3*a*, 3*b*. Mature leaves; 3*c*, buds; 3*d*, front and back views of anther; 3*e*, fruits. Mundijong, 29 miles south of Perth, Western Australia, on the Bunbury Line. (Dr. J. B. Cleland.) The type.



EUCALYPTUS HOUSEANA (W. V. Fitzgerald) Maiden.

EUCALYPTUS JUTSONI Maiden (*1*).
EUCALYPTUS ADJUNCTA Maiden (*2*).

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EUCALYPTUS PILULARIS SM., *var.* PYRIFORMIS MAIDEN (*1*).
[See also Plate 1, Part 1.]

EUCALYPTUS PUMILA CAMBAGE (*2*).

EUCALYPTUS RARIFLORA Bailey (*1, 2*).
EUCALYPTUS MUNDIJONGENSIS Maiden (*3*).

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The following species of Eucalyptus are illustrated in my "Forest Flora of New South Wales"* with larger twigs than is possible in the present work; photographs of the trees are also introduced wherever possible. Details in regard to their economic value, &c., are given at length in that work, which is a popular one. The number of the Part of the Forest Flora is given in brackets :—

acacicides A. Cunn. (xlviii).
acmenioides Schauer (xxxii).
affinis Deane and Maiden (lvi).
amygdalina Labill. (xvi).
Andrewsi Maiden (xxi).
Baileyana F.v.M. (xxxv).
Baueriana Schauer (lvii).
Baueriana Schauer var. *conica* Maiden (lviii).
Behriana F.v.M. (xlvi).
bicolor A. Cunn. (xliv).
Boormani Deane and Maiden (xlv).
Bosistoana F.v.M. (xliii).
Caleyi Maiden (lv).
capitellata Sm. (xxviii).
conica Deane and Maiden (lviii).
Consideniana Maiden (xxxvi).
coriacea A. Cunn. (xv).
corymbosa Sm. (xii).
crebra F.v.M. (liii).
Dalrympleana Maiden (lxiv).
dives Schauer (xix).
dumosa A. Cunn. (lxv).
eugenioides Sieber. (xxix).
fruticetorum F.v.M. (xlii).
gigantea Hook. f. (li).
globulus L'Her. (lxvii).
goniocalyx F.v.M. (vi).
hæmastoma Sm. (xxxvii).
hemiphloia F.v.M. (vi).
longifolia Link and Otto (ii).
Luehmanniana F.v.M. (xxvi).
macrorrhyncha F.v.M. (xxvii).
maculata Hook. (vii).
melanophloia F.v.M. (liv).
melliodora A. Cunn. (ix).
microcorys F.v.M. (xxxviii).
microtheca F.v.M. (lii).
Muelleriana Howitt (xxx).
numerosa Maiden (xvii).
obliqua L'Hérit. (xxii).
ochrophloia F.v.M. (l).
odorata Behr and Schlectendal (xli).
oleosa F.v.M. (lx).
paniculata Sm. (viii).
pilularis Sm. (xxxi).
piperita Sm. (xxxiii).
Planchoniana F.v.M. (xxiv).
polyanthemos Schauer (lix).
populifolia Hook. (xlvii).
propinqua Deane and Maiden (lxi).
punctata DC. (x).
radiata Sieb., as *amygdalina* (xvi).
regnans F.v.M. (xviii).
resinifera Sm. (iii).
rostrata Schlecht. (lxii).
rubida Deane and Maiden (xliii).
saligna Sm. (iv).
siderophloia Benth. (xxxix).
sideroxylon A. Cunn. (xiii).
Sieberiana F.v.M. (xxxiv).
stellulata Sieb. (xiv).
tereticornis Sm. (xi).
tessellaris F.v.M. (lxvi).
Thozetiana F.v.M. (xlix).
viminalis Labill. (lxiv).
virgata Sieb. (xxv).
vitrea R. T. Baker (xxiii).

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* Government Printer, Sydney. 4to. Each part contains 4 plates and other illustrations.

NOTE BY GOVERNMENT PRINTER.

War conditions have so largely affected publications that it is no longer possible to continue the issue of "The Forest Flora of New South Wales" at the old rates, and from this date onward, *i.e.*, from and including Part 7, Vol. VII, the price of the individual Parts will be raised to 2s. 6d. each.

For those Parts already published the old sale price will be adhered to, and subscriptions already received will not be disturbed, but the new subscription rate of 2s. 6d. per part, or 25s. for 12 parts, will come into effect as from the 1st July, 1921.

Sydney: William Applegate Gullick, Government Printer—1921.

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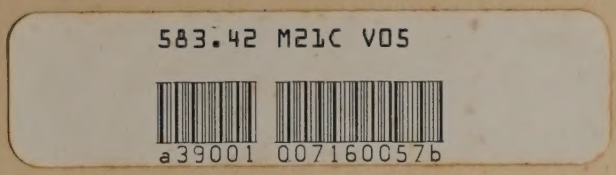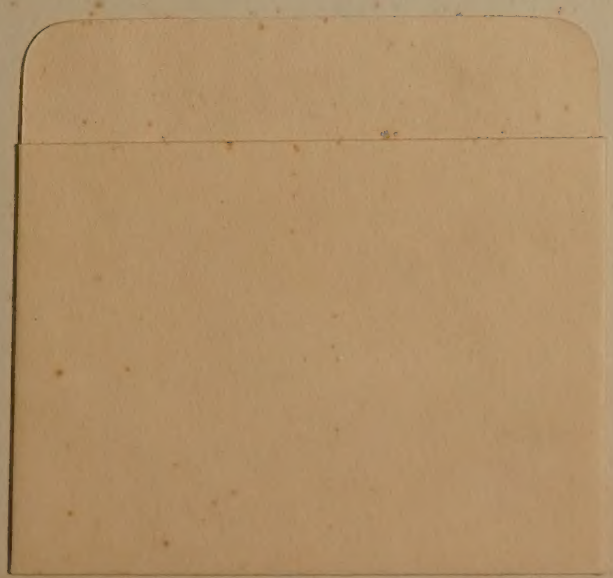
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